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JACKSON WALKER L.L.P.

FACSIMILE

DATE: January 31, 2002

TOTAL PAGE COUNT: 7

FROM: THOMAS E. SISSON

DIRECT DIAL NUMBER:

NAME	COMPANY NAME	FACSIMILE NUMBER	PHONE NUMBER
MS. WALLACE	USPTO	(703) 305-3230	

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CLIENT/MATTER NO.: 304042.00226

TIMEKEEPER: TES1

MESSAGE:

→ **MS. WALLACE**
I AM FAXING YOU THE PCT/RO/101 FORM YOU REQUESTED. THIS RELATES TO US PAT. APPLICATION SN 09/980,949, CORRESPONDING TO PCT/IB01/01867.
THANK YOU FOR YOUR HELP.
RESPECTFULLY,
THOMAS E. SISSON

PCT

REQUEST

The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty.

For receiving Office use only

PCT / IB 0 1 / 0 1 8 6 7
International Application No.

11 SEPTEMBER 2001 (11.09.01)
International Filing Date

INTERNATIONAL BUREAU OF WIPO
PCT International Application
Name of receiving Office and "PCT International Application"

Applicant's or agent's file reference (If desired) (12 characters maximum) WPP82827

Box No. I TITLE OF INVENTION
MOBILE COMMUNCATIONS

Box No. II APPLICANT ☐ This person is also inventor

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

Hong Kong CSL Limited
8/F Oxford House
Taikoo Place
979 King's Road
Quarry Bay
Hong Kong (CN)

Telephone No.

Facsimile No.

Teleprinter No.

Applicant's registration No. with the Office

State *(that is, country)* of nationality: HK

State *(that is, country)* of residence: HK CN

This person is applicant for the purposes of: ☐ all designated States ☒ all designated States except the United States of America ☐ the United States of America only ☐ the States indicated in the Supplemental Box

Box No. III FURTHER APPLICANT(S) AND/OR (FURTHER) INVENTOR(S)

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

LEUNG, Edward Yan Tao
Flat 27c, Tower 1,
Well On Garden,
Tseung Kwan O,
Hong Kong (CN)

This person is:
☐ applicant only
☒ applicant and inventor
☐ inventor only *(If this check-box is marked, do not fill in below.)*

Applicant's registration No. with the Office

State *(that is, country)* of nationality: CN

State *(that is, country)* of residence: HK CN

This person is applicant for the purposes of: ☐ all designated States ☐ all designated States except the United States of America ☒ the United States of America only ☐ the States indicated in the Supplemental Box

☒ Further applicants and/or (further) inventors are indicated on a continuation sheet.

Box No. IV AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCE

RO

The person identified below is hereby/has been appointed to act on behalf of the applicant(s) before the competent International Authorities as: ☒ agent ☐ common representative

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

Godwin, Edgar James
Marks & Clerk
57-60 Lincolns Inn Fields
London WC2A 3LS
United Kingdom

Telephone No.
020 7400 3000

Facsimile No.
020 7404 4910

Teleprinter No.
25311 EMANDC G

Agent's registration No. with the Office

☒ **Address for correspondence:** Mark this check-box where no agent or common representative is/has been appointed and the space above is used instead to indicate a special address to which correspondence should be sent.

Continuation of Box No. III FURTHER APPLICANT(S) AND/OR (FURTHER) INVENTOR(S)

If none of the following sub-boxes is used, this sheet should not be included in the request.

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

MIDGETT, Richard
c/o Hong Kong CSL Ltd
8/F Oxford House, Taikoo Place
979 King's Road
Quarry Bay
Hong Kong (CN)

This person is:
- ☐ applicant only
- ☒ applicant and inventor
- ☐ inventor only *(If this check-box is marked, do not fill in below.)*

Applicant's registration No. with the Office

State *(that is, country)* of nationality: US

State *(that is, country)* of residence: [HK] CN

This person is applicant for the purposes of:
- ☐ all designated States
- ☐ all designated States except the United States of America
- ☒ the United States of America only
- ☐ the States indicated in the Supplemental Box

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

YAU, Kwok Wing
c/o Hong Kong CSL Ltd
8/F Oxford House, Taikoo Place
979 King's Road
Quarry Bay
Hong Kong (CN)

This person is:
- ☐ applicant only
- ☒ applicant and inventor
- ☐ inventor only *(If this check-box is marked, do not fill in below.)*

Applicant's registration No. with the Office

State *(that is, country)* of nationality:

State *(that is, country)* of residence: [HK] CN

This person is applicant for the purposes of:
- ☐ all designated States
- ☐ all designated States except the United States of America
- ☒ the United States of America only
- ☐ the States indicated in the Supplemental Box

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

This person is:
- ☐ applicant only
- ☐ applicant and inventor
- ☐ inventor only *(If this check-box is marked, do not fill in below.)*

Applicant's registration No. with the Office

State *(that is, country)* of nationality:

State *(that is, country)* of residence:

This person is applicant for the purposes of:
- ☐ all designated States
- ☐ all designated States except the United States of America
- ☐ the United States of America only
- ☐ the States indicated in the Supplemental Box

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

This person is:
- ☐ applicant only
- ☐ applicant and inventor
- ☐ inventor only *(If this check-box is marked, do not fill in below.)*

Applicant's registration No. with the Office

State *(that is, country)* of nationality:

State *(that is, country)* of residence:

This person is applicant for the purposes of:
- ☐ all designated States
- ☐ all designated States except the United States of America
- ☐ the United States of America only
- ☐ the States indicated in the Supplemental Box

☐ Further applicants and/or (further) inventors are indicated on another continuation sheet.

Box No.V DESIGNATION OF STATES *Mark the applicable check-boxes below: at least one must be marked.*

The following designations are hereby made under Rule 4.9(a):

Regional Patent

- [X] AP **ARIPO Patent:** GH Ghana, GM Gambia, KE Kenya, LS Lesotho, MW Malawi, MZ Mozambique, SD Sudan, SL Sierra Leone, SZ Swaziland, TZ United Republic of Tanzania, UG Uganda, ZW Zimbabwe, and any other State which is a Contracting State of the Harare Protocol and of the PCT
- [X] EA **Eurasian Patent:** AM Armenia, AZ Azerbaijan, BY Belarus, KG Kyrgyzstan, KZ Kazakhstan, MD Republic of Moldova, RU Russian Federation, TJ Tajikistan, TM Turkmenistan, and any other State which is a Contracting State of the Eurasian Patent Convention and of the PCT
- [X] EP **European Patent:** AT Austria, BE Belgium, CH & LI Switzerland and Liechtenstein, CY Cyprus, DE Germany, DK Denmark, ES Spain, FI Finland, FR France, GB United Kingdom, GR Greece, IE Ireland, IT Italy, LU Luxembourg, MC Monaco, NL Netherlands, PT Portugal, SE Sweden, TR Turkey, and any other State which is a Contracting State of the European Patent Convention and of the PCT
- [X] OA **OAPI Patent:** BF Burkina Faso, BJ Benin, CF Central African Republic, CG Congo, CI Côte d'Ivoire, CM Cameroon, GA Gabon, GN Guinea, GW Guinea-Bissau, ML Mali, MR Mauritania, NE Niger, SN Senegal, TD Chad, TG Togo, and any other State which is a member State of OAPI and a Contracting State of the PCT *(if other kind of protection or treatment desired, specify on dotted line)* .....

National Patent *(if other kind of protection or treatment desired, specify on dotted line)*:

- [X] AE United Arab Emirates
- [X] AG Antigua and Barbuda
- [X] AL Albania
- [X] AM Armenia
- [X] AT Austria
- [X] AU Australia
- [X] AZ Azerbaijan
- [X] BA Bosnia and Herzegovina
- [X] BB Barbados
- [X] BG Bulgaria
- [X] BR Brazil
- [X] BY Belarus
- [X] BZ Belize
- [X] CA Canada
- [X] CH & LI Switzerland and Liechtenstein
- [X] CN China
- [X] CO Colombia
- [X] CR Costa Rica
- [X] CU Cuba
- [X] CZ Czech Republic
- [X] DE Germany
- [X] DK Denmark
- [X] DM Dominica
- [X] DZ Algeria
- [X] EE Estonia
- [X] ES Spain
- [X] FI Finland
- [X] GB United Kingdom
- [X] GD Grenada
- [X] GE Georgia
- [X] GH Ghana
- [X] GM Gambia
- [X] HR Croatia
- [X] HU Hungary
- [X] ID Indonesia
- [X] IL Israel
- [X] IN India
- [X] IS Iceland
- [X] JP Japan
- [X] KE Kenya
- [X] KG Kyrgyzstan
- [X] KP Democratic People's Republic of Korea
- [X] KR Republic of Korea
- [X] KZ Kazakhstan
- [X] LC Saint Lucia
- [X] LK Sri Lanka
- [X] LR Liberia
- [X] LS Lesotho
- [X] LT Lithuania
- [X] LU Luxembourg
- [X] LV Latvia
- [X] MA Morocco
- [X] MD Republic of Moldova
- [X] MG Madagascar
- [X] MK The former Yugoslav Republic of Macedonia
- [X] MN Mongolia
- [X] MW Malawi
- [X] MX Mexico
- [X] MZ Mozambique
- [X] NO Norway
- [X] NZ New Zealand
- [X] PL Poland
- [X] PT Portugal
- [X] RO Romania
- [X] RU Russian Federation
- [X] SD Sudan
- [X] SE Sweden
- [X] SG Singapore
- [X] SI Slovenia
- [X] SK Slovakia
- [X] SL Sierra Leone
- [X] TJ Tajikistan
- [X] TM Turkmenistan
- [X] TR Turkey
- [X] TT Trinidad and Tobago
- [X] TZ United Republic of Tanzania
- [X] UA Ukraine
- [X] UG Uganda
- [X] US United States of America
- [X] UZ Uzbekistan
- [X] VN Viet Nam
- [X] YU Yugoslavia
- [X] ZA South Africa
- [X] ZW Zimbabwe

RO

Check-boxes below reserved for designating States which have become party to the PCT after issuance of this sheet:

- [X] Plus any other states not listed
- [X] EC Ecuador
- [X] PH Philippines
- [ ] .....
- [ ] .....

Precautionary Designation Statement: In addition to the designations made above, the applicant also makes under Rule 4.9(b) all other designations which would be permitted under the PCT except any designation(s) indicated in the Supplemental Box as being excluded from the scope of this statement. The applicant declares that those additional designations are subject to confirmation and that any designation which is not confirmed before the expiration of 15 months from the priority date is to be regarded as withdrawn by the applicant at the expiration of that time limit. *(Confirmation (including fees) must reach the receiving Office within the 15-month time limit.)*

Box No. VI PRIORITY CLAIM

The priority of the following earlier application(s) is hereby claimed:

Filing date of earlier application (day/month/year)	Number of earlier application	Where earlier application is:		
		national application: country	regional application:* regional Office	international application: receiving Office
item (1) 11-9-00 11 Sept 2000	0022205.9	~~United Kingdom~~ GB		
item (2)				
item (3)				
item (4)				
item (5)				

☐ Further priority claims are indicated in the Supplemental Box.

The receiving Office is requested to prepare and transmit to the International Bureau a certified copy of the earlier application(s) *(only if the earlier application was filed with the Office which for the purposes of this international application is the receiving Office)* identified above as:

☐ all items ☒ item (1) ☐ item (2) ☐ item (3) ☐ item (4) ☐ item (5) ☐ other, see Supplemental Box

** Where the earlier application is an ARIPO application, indicate at least one country party to the Paris Convention for the Protection of Industrial Property or one Member of the World Trade Organization for which that earlier application was filed (Rule 4.10(b)(ii)):* ....

.....

Box No. VII INTERNATIONAL SEARCHING AUTHORITY

ARO

Choice of International Searching Authority (ISA) *(if two or more International Searching Authorities are competent to carry out the international search, indicate the Authority chosen; the two-letter code may be used):*

ISA / .....

Request to use results of earlier search; reference to that search *(if an earlier search has been carried out by or requested from the International Searching Authority):*

Date *(day/month/year)* Number Country *(or regional Office)*

Box No. VIII DECLARATIONS

The following declarations are contained in Boxes Nos. VIII (i) to (v) *(mark the applicable check-boxes below and indicate in the right column the number of each type of declaration)*: Number of declarations

☐ Box No. VIII (i)	Declaration as to the identity of the inventor	:
☐ Box No. VIII (ii)	Declaration as to the applicant's entitlement, as at the international filing date, to apply for and be granted a patent	:
☐ Box No. VIII (iii)	Declaration as to the applicant's entitlement, as at the international filing date, to claim the priority of the earlier application	:
☐ Box No. VIII (iv)	Declaration of inventorship (only for the purposes of the designation of the United States of America)	:
☐ Box No. VIII (v)	Declaration as to non-prejudicial disclosures or exceptions to lack of novelty	:

Sheet No. 5

Box No. IX · CHECKLIST; LANGUAGE OF FILING

This international application contains:

(a) the following number of sheets in paper form:		
request (including declaration sheets)	:	5
description (excluding sequence listing part)	:	14
claims	:	2
abstract	:	1
drawings	:	5
Sub-total number of sheets	:	27
sequence listing part of description *(actual number of sheets if filed in paper form whether or not also filed in computer readable form; see (b) below)*	:	
Total number of sheets	:	27

(b) sequence listing part of description filed in computer readable form

(i) ☐ only (under Section 801(a)(i))

(ii) ☐ in addition to being filed in paper form (under Section 801(a)(ii))

Type and number of carriers (diskette, CD-ROM, CD-Rother) on which the sequence listing part is contained *(additional copies to be indicated under item 9 (ii), in right column)*: .....

Figure of the drawings which should accompany the abstract: .....

This international application is accompanied by the following item(s) *(mark the applicable check-boxes below and indicate in right column the number of each item)*:

		Number of items
1. ☒	fee calculation sheet	
2. ☐	original separate power of attorney	:
3. ☐	original general power of attorney	:
4. ☐	copy of general power of attorney; reference number, if any:	:
5. ☐	statement explaining lack of signature	
6. ☐	priority document(s) identified in Box No. VI as item(s):	:
7. ☐	translation of international application into (language):	:
8. ☐	separate indications concerning deposited microorganism or other biological material	
9. ☐	sequence listing in computer readable form (indicate also type and number of carriers (diskette, CD-ROM, CD-Rother))	:
	(i) ☐ copy submitted for the purposes of international search under Rule 13*ter* only (and not as part of the international application)	
	(ii) ☐ *(only where check-box (b)(i) or (b)(ii) is marked in left column)* additional copies including, where applicable, the copy for the purposes of international search under Rule 13 *ter*	:
	(iii) ☐ together with relevant statement as to the identity of the copy or copies with the sequence listing part mentioned in left column	:
10. ☒	other *(specify)*: 23.177	:

Language of filing of the international application: .....

Box No. X · SIGNATURE OF APPLICANT, AGENT OR COMMON REPRESENTATIVE

Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the request).

By Edward A. Meilman
Edward A. Meilman
Ostrolenk, Faber, Gerb & Soffen, LLP

For Receiving Office use only

1. Date of actual receipt of the purported international application:

2. Drawings:
☐ received:
☐ not received:

3. Corrected date of actual receipt due to later but timely received papers or drawings completing the purported international application:

4. Date of timely receipt of the required corrections under PCT Article 11(2):

5. International Searching Authority (if two or more are competent): ISA/

6. ☐ Transmittal of search copy delayed until search fee is paid

For International Bureau use only

Date of receipt of the record copy by the International Bureau:

PATENT COOPERATION TREATY

From the RECEIVING OFFICE

PCT

NOTIFICATION OF THE INTERNATIONAL APPLICATION NUMBER AND OF THE INTERNATIONAL FILING DATE

(PCT Rule 20.5(c))

To:

GODWIN, Edgar, James
Marks & Clerk
57-60 Lincolns Inn Fields
London WC2A 3LS
ROYAUME-UNI

Date of mailing (day/month/year)	
09 October 2001 (09.10.01)	
Applicant's or agent's file reference	**IMPORTANT NOTIFICATION**
WPP82827	

International application No.	International filing date (day/month/year)	Priority date (day/month/year)
PCT/IB01/01867	11 September 2001 (11.09.01)	11 September 2000 (11.09.00)

Applicant HONG KONG CSL LIMITED et al

Title of the invention MOBILE COMMUNICATIONS

1. The applicant is hereby notified that the international application has been accorded the international application number and the international filing date indicated above.

2. The applicant is further notified that the record copy of the international application:

[x] was transmitted to the International Bureau on 09 October 2001 (09.10.01)

[ ] has not yet been transmitted to the International Bureau for the reason indicated below and a copy of this notification has been sent to the International Bureau*:

[ ] because the necessary national security clearance has not yet been obtained.

[ ] because (reason to be specified):

* The International Bureau monitors the transmittal of the record copy by the receiving Office and will notify the applicant (with Form PCT/IB/301) of its receipt. Should the record copy not have been received by the expiration of 14 months from the priority date, the International Bureau will notify the applicant (Rule 22.1(c)).

Name and mailing address of the receiving Office	Authorised officer
International Bureau of WIPO PCT Receiving Office Section 34, chemin des Colombettes, 1211 Geneva 20, Switzerland Facsimile No. (41-22) 910 06 10	Corina Cupello Telephone No. (41-22) 338 83 55

09980.999

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference	**FOR FURTHER ACTION**	see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.
WPP82827		
International application No.	International filing date *(day/month/year)*	(Earliest) Priority Date *(day/month/year)*
PCT/IB 01/01867	11/09/2001	11/09/2000
Applicant		
HONG KONG CSL LIMITED		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 3 sheets.

[X] It is also accompanied by a copy of each prior art document cited in this report.

1. **Basis of the report**

   a. With regard to the **language**, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

   [ ] the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

   b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing :

   [ ] contained in the international application in written form.

   [ ] filed together with the international application in computer readable form.

   [ ] furnished subsequently to this Authority in written form.

   [ ] furnished subsequently to this Authority in computer readble form.

   [ ] the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

   [ ] the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. [ ] **Certain claims were found unsearchable** (See Box I).

3. [ ] **Unity of invention is lacking** (see Box II).

4. With regard to the **title,**

   [ ] the text is approved as submitted by the applicant.

   [X] the text has been established by this Authority to read as follows:

   ROAMING SERVICE FOR MOBILE COMMUNICATIONS

5. With regard to the **abstract,**

   [X] the text is approved as submitted by the applicant.

   [ ] the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No. _____

   [ ] as suggested by the applicant.

   [ ] because the applicant failed to suggest a figure.

   [ ] because this figure better characterizes the invention.

   [X] None of the figures.

INTERNATIONAL SEARCH REPORT

International Application No
P[redacted]/IB 01/01867

A. CLASSIFICATION OF SUBJECT MATT[redacted]
IPC 7 H04Q7/32

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 781 064 A (NOKIA MOBILE PHONES LTD) 25 June 1997 (1997-06-25) column 4, line 52 -column 5, line 10 column 6, line 6 - line 8 column 12, line 49 - line 52 column 14, line 27 ---	1,2,5
E	FR 2 808 645 A (FRANCE TELECOM) 9 November 2001 (2001-11-09) the whole document ---	1
X	WO 99 40746 A (QUALCOMM INC) 12 August 1999 (1999-08-12) page 8, line 5 - line 7 ---	1
	-/--	

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
15 February 2002	27/02/2002

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Leouffre, M

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

International Application No
PCT/IB 01/01867

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
X	ETSI: "Digital cellular telecommunications system (Phase 2+);Specification of the Subscriber Identity Module - Mobile Equipment (SIM - ME) interface (GSM 11.11 version 6.2.0 Release 1997)" TS 100977 V6.2.0, XX, XX, May 1999 (1999-05), XP002158150 cited in the application the whole document	1

2

Form PCT/ISA/210 (continuation of second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
[redacted]/IB 01/01867

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
EP 0781064	A	25-06-1997	US	5903832 A	11-05-1999
			EP	0781064 A2	25-06-1997
FR 2808645	A	09-11-2001	FR	2808645 A1	09-11-2001
			WO	0186995 A1	15-11-2001
WO 9940746	A	12-08-1999	AU	2666099 A	23-08-1999
			WO	9940746 A1	12-08-1999

XP-002158150

TS 100 977 V6.2.0 (1999-05)

Technical Specification

Digital cellular telecommunications system (Phase 2+); Specification of the Subscriber Identity Module - Mobile Equipment (SIM - ME) interface (GSM 11.11 version 6.2.0 Release 1997)

Reference
RTS/SMG-091111Q6R1 (91o030o3.PDF)

Keywords
Digital cellular telecommunications system,
Global System for Mobile communications (GSM)

ETSI

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F-06921 Sophia Antipolis Cedex - FRANCE

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650 Route des Lucioles - Sophia Antipolis
Valbonne - FRANCE
Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16
Siret N° 348 623 562 00017 - NAF 742 C
Association à but non lucratif enregistrée à la
Sous-Préfecture de Grasse (06) N° 7803/88

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secretariat@etsi.fr
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comment to: editor@etsi.fr

Contents

Intellectual Property Rights

IPRs essential or potentially essential to the present document may have been declared to ETSI. The information pertaining to these essential IPRs, if any, is publicly available for **ETSI members and non-members**, and can be found in SR 000 314: *"Intellectual Property Rights (IPRs); Essential, or potentially Essential, IPRs notified to ETSI in respect of ETSI standards"*, which is available **free of charge** from the ETSI Secretariat. Latest updates are available on the ETSI Web server (http://www.etsi.org/ipr).

Pursuant to the ETSI IPR Policy, no investigation, including IPR searches, has been carried out by ETSI. No guarantee can be given as to the existence of other IPRs not referenced in SR 000 314 (or the updates on the ETSI Web server) which are, or may be, or may become, essential to the present document.

Foreword

This Technical Specification (TS) has been produced by the Special Mobile Group (SMG).

The present document defines the interface between the Subscriber Identity Module (SIM) and the Mobile Equipment (ME) within the digital cellular telecommunications system.

The contents of the present document are subject to continuing work within SMG and may change following formal SMG approval. Should SMG modify the contents of the present document it will then be republished by ETSI with an identifying change of release date and an increase in version number as follows:

Version 6.x.y

where:

- 6 indicates GSM Release 1997 of Phase 2+
- y the third digit is incremented when editorial only changes have been incorporated in the specification;
- x the second digit is incremented for all other types of changes, i.e. technical enhancements, corrections, updates, etc.

1 Scope

The present document defines the interface between the Subscriber Identity Module (SIM) and the Mobile Equipment (ME) for use during the network operation phase of GSM as well as those aspects of the internal organization of the SIM which are related to the network operation phase. This is to ensure interoperability between a SIM and an ME independently of the respective manufacturers and operators. The concept of a split of the Mobile Station (MS) into these elements as well as the distinction between the GSM network operation phase, which is also called GSM operations, and the administrative management phase are described in the GSM 02.17 [6].

The present document defines:

- the requirements for the physical characteristics of the SIM, the electrical signals and the transmission protocols;
- the model which shall be used as a basis for the design of the logical structure of the SIM;
- the security features;
- the interface functions;
- the commands;
- the contents of the files required for the GSM application;
- the application protocol.

Unless otherwise stated, references to GSM also apply to DCS 1800.

The present document does not specify any aspects related to the administrative management phase. Any internal technical reallocation of either the SIM or the ME are only specified where these reflect over the interface. It does not specify any of the security algorithms which may be used.

The present document defines the SIM/ME interface for GSM Phase 2. While all attempts have been made to maintain phase compatibility, any issues that specifically relate to Phase 1 should be referenced from within the relevant Phase 1 specification.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.
- A non-specific reference to an ETS shall also be taken to refer to later versions published as an EN with the same number.
- For this Release 1997 document, references to GSM documents are for Release 1997 versions (version 6.x.y).

[1] GSM 01.02: "Digital cellular telecommunications system (Phase 2+); General description of a GSM Public Land Mobile Network (PLMN)".

[2] GSM 01.04: "Digital cellular telecommunications system (Phase 2+); Abbreviations and acronyms".

[3] GSM 02.07: "Digital cellular telecommunications system (Phase 2+); Mobile Stations (MS) features".

[4] GSM 02.09: "Digital cellular telecommunications system (Phase 2+); Security aspects".

[5] GSM 02.11: "Digital cellular telecommunications system (Phase 2+); Service accessibility".

[6] GSM 02.17: "Digital cellular telecommunications system (Phase 2+); Subscriber Identity Modules (SIM) Functional characteristics".

[7] GSM 02.24: "Digital cellular telecommunications system (Phase 2+); Description of Charge Advice Information (CAI)".

[8] GSM 02.30: "Digital cellular telecommunications system (Phase 2+); Man-Machine Interface (MMI) of the Mobile Station (MS)".

[9] GSM 02.86: "Digital cellular telecommunications system (Phase 2+); Advice of charge (AoC) Supplementary Services - Stage 1".

[10] GSM 03.03: "Digital cellular telecommunications system (Phase 2+); Numbering, addressing and identification".

[11] GSM 03.20: "Digital cellular telecommunications system (Phase 2+); Security related network functions".

[12] GSM 03.38: "Digital cellular telecommunications system (Phase 2+); Alphabets and language-specific information".

[13] GSM 03.40: "Digital cellular telecommunications system (Phase 2+); Technical realization of the Short Message Service (SMS) Point-to-Point (PP)".

[14] GSM 03.41: "Digital cellular telecommunications system (Phase 2+); Technical realization of Short Message Service Cell Broadcast (SMSCB)".

[15] GSM 04.08: "Digital cellular telecommunications system (Phase 2+); Mobile radio interface layer 3 specification".

[16] GSM 04.11: "Digital cellular telecommunications system (Phase 2+); Point-to-Point (PP) Short Message Service (SMS) support on mobile radio interface".

[17] GSM 09.91 (ETR 174): "Digital cellular telecommunications system; Interworking aspects of the Subscriber Identity Module - Mobile Equipment (SIM - ME) interface between Phase 1 and Phase 2".

[18] CCITT Recommendation E.118: "The international telecommunication charge card".

[19] CCITT Recommendation E.164: "Numbering plan for the ISDN era".

[20] CCITT Recommendation T.50: "International Alphabet No. 5". (ISO 646: 1983, Information processing - ISO 7-bits coded characters set for information interchange).

[21] ISO/IEC 7810 (1995): "Identification cards - Physical characteristics".

[22] ISO/IEC 7811-1 (1995): "Identification cards - Recording technique - Part 1: Embossing".

[23] ISO/IEC 7811-3 (1995): "Identification cards - Recording technique - Part 3: Location of embossed characters on ID-1 cards".

[24] ISO 7816-1 (1987): "Identification cards - Integrated circuit(s) cards with contacts, Part 1: Physical characteristics".

[25] ISO 7816-2 (1988): "Identification cards - Integrated circuit(s) cards with contacts, Part 2: Dimensions and locations of the contacts".

[26] ISO/IEC 7816-3 (1989): "Identification cards - Integrated circuit(s) cards with contacts, Part 3: Electronic signals and transmission protocols".

[27] GSM 11.14 (TS 101 267): "Digital cellular telecommunications system (Phase 2+); Specification of the SIM Application Toolkit for the Subscriber Identity Module - Mobile Equipment (SIM - ME) interface".

[28] GSM 11.12: "Digital cellular telecommunications system (Phase 2); Specification of the 3 Volt Subscriber Identity Module - Mobile Equipment (SIM - ME) interface".

[29] GSM 02.22: "Digital cellular telecommunications system (Phase 2+); Personalization of GSM Mobile Equipment (ME) Mobile functionality specification".

[30] ISO 639 (1988): "Code for the representation of names of languages".

[31] ISO/IEC 10646-1:1993 "Information technology -- Universal Multiple-Octet Coded Character Set (UCS) -- Part 1: Architecture and Basic Multilingual Plane"

[32] GSM 03.60: "Digital cellular telecommunications system (Phase 2+); General Packet Radio ervice (GPRS); Service description; Stage 2"

3 Definitions, abbreviations and symbols

3.1 Definitions

For the purposes of the present document, the following terms and definitions apply. For further information and definitions refer to GSM 01.02 [1].

access conditions: A set of security attributes associated with a file.

application: An application consists of a set of security mechanisms, files, data and protocols (excluding transmission protocols).

application protocol: The set of procedures required by the application.

card session: A link between the card and the external world starting with the ATR and ending with a subsequent reset or a deactivation of the card.

current directory: The latest MF or DF selected.

current EF: The latest EF selected.

data field: Obsolete term for Elementary File.

Dedicated File (DF): A file containing access conditions and, optionally, Elementary Files (EFs) or other Dedicated Files (DFs).

directory: General term for MF and DF.

Elementary File (EF): A file containing access conditions and data and no other files.

file: A directory or an organized set of bytes or records in the SIM.

file identifier: The 2 bytes which address a file in the SIM.

GSM or DCS 1800 application: Set of security mechanisms, files, data and protocols required by GSM or DCS 1800.

GSM session: That part of the card session dedicated to the GSM operation.

IC card SIM: Obsolete term for ID-1 SIM.

ID-1 SIM: The SIM having the format of an ID-1 card (see ISO 7816-1 [24]).

Master File (MF): The unique mandatory file containing access conditions and optionally DFs and/or EFs.

normal GSM operation: Relating to general, CHV related, GSM security related and subscription related procedures.

padding: One or more bits appended to a message in order to cause the message to contain the required number of bits or bytes.

plug-in SIM: A Second format of SIM (specified in clause 4).

proactive SIM: A SIM which is capable of issuing commands to the ME. Part of SIM Application Toolkit (see clause 11).

record: A string of bytes within an EF handled as a single entity (see clause 6).

record number: The number which identifies a record within an EF.

record pointer: The pointer which addresses one record in an EF.

root directory: Obsolete term for Master File.

SIM application toolkit procedures: Defined in GSM 11.14 [27].

3.2 Abbreviations

For the purposes of the present document, the following abbreviations apply, in addition to those listed in GSM 01.04 [2]:

A3	Algorithm 3, authentication algorithm; used for authenticating the subscriber
A5	Algorithm 5, cipher algorithm; used for enciphering/deciphering data
A8	Algorithm 8, cipher key generator; used to generate K_c
A38	A single algorithm performing the functions of A3 and A8
ACM	Accumulated Call Meter
ADN	Abbreviated Dialling Number
ADM	Access condition to an EF which is under the control of the authority which creates this file
ALW	ALWays
AoC	Advice of Charge
APDU	Application Protocol Data Unit
ATR	Answer To Reset
BCCH	Broadcast Control CHannel
BCD	Binary Coded Decimal
BDN	Barred Dialling Number
BTS	Base Transmitter Station
CB	Cell Broadcast
CBMI	Cell Broadcast Message Identifier
CCITT	The International Telegraph and Telephone Consultative Committee (now also known as the ITU Telecommunications Standardization sector)
CCP	Capability/Configuration Parameter
CHV	Card Holder Verification information; access condition used by the SIM for the verification of the identity of the user
CLA	CLAss
CNL	Co-operative Network List
DCK	De-personalization Control Keys
DCS	Digital Cellular System
DF	Dedicated File (abbreviation formerly used for Data Field)
DTMF	Dual Tone Multiple Frequency
ECC	Emergency Call Code
EF	Elementary File
ETSI	European Telecommunications Standards Institute
eMLPP	enhanced Multi-Level Precedence and Pre-emption Service
etu	elementary time unit
FDN	Fixed Dialling Number
GSM	Global System for Mobile communications
HPLMN	Home PLMN
IC	Integrated Circuit
ICC	Integrated Circuit(s) Card
ID	IDentifier
IEC	International Electrotechnical Commission
IMSI	International Mobile Subscriber Identity
ISO	International Organization for Standardization
Kc	Cryptographic key; used by the cipher A5

Ki	Subscriber authentication key; the cryptographic key used by the authentication algorithm, A3, and cipher key generator, A8
LAI	Location Area Information; information indicating a cell or a set of cells
lgth	The (specific) length of a data unit
LND	Last Number Dialled
LSB	Least Significant Bit
MCC	Mobile Country Code
ME	Mobile Equipment
MF	Master File
MMI	Man Machine Interface
MNC	Mobile Network Code
MS	Mobile Station
MSISDN	Mobile Station international ISDN number
MSB	Most Significant Bit
NET	NETwork
NEV	NEVer
NPI	Numbering Plan Identifier
PIN/PIN2	Personal Identification Number / Personal Identification Number 2 (obsolete terms for CHV1 and CHV2, respectively)
PLMN	Public Land Mobile Network
PTS	Protocol Type Select (response to the ATR)
PUK/PUK2	PIN Unblocking Key / PIN2 Unblocking Key (obsolete terms for UNBLOCK CHV1 and UNBLOCK CHV2, respectively)
RAND	A RANDom challenge issued by the network
RFU	Reserved for Future Use
SDN	Service Dialling Number
SIM	Subscriber Identity Module
SMS	Short Message Service
SRES	Signed RESponse calculated by a SIM
SSC	Supplementary Service Control string
SW1/SW2	Status Word 1 / Status Word 2
TMSI	Temporary Mobile Subscriber Identity
TON	Type Of Number
TP	Transfer layer Protocol
TPDU	Transfer Protocol Data Unit
TS	Technical Specification
UNBLOCK CHV	1/2 value to unblock CHV1/CHV2
VBS	Voice Broadcast Service
VGCS	Voice Group Call Service
VPLMN	Visited PLMN

3.3 Symbols

Vcc	Supply voltage
Vpp	Programming voltage
'0' to '9' and 'A' to 'F'	The sixteen hexadecimal digits

4 Physical characteristics

Two physical types of SIM are specified. These are the "ID-1 SIM" and the "Plug-in SIM".

The physical characteristics of both types of SIM shall be in accordance with ISO 7816-1,2 [24, 25] unless otherwise specified. The following additional requirements shall be applied to ensure proper operation in the GSM environment.

4.1 Format and layout

The information on the exterior of either SIM should include at least the individual account identifier and the check digit of the IC Card Identification (see clause 10, EF_{ICCID}).

4.1.1 ID-1 SIM

Format and layout of the ID-1 SIM shall be in accordance with ISO 7816-1,2 [24, 25].

The card shall have a polarization mark (see GSM 02.07 [3]) which indicates how the user should insert the card into the ME.

The ME shall accept embossed ID-1 cards. The embossing shall be in accordance with ISO/IEC 7811 [22, 23]. The contacts of the ID-1 SIM shall be located on the front (embossed face, see ISO/IEC 7810 [21]) of the card.

NOTE: Card warpage and tolerances are now specified for embossed cards in ISO/IEC 7810 [21].

4.1.2 Plug-in SIM

The Plug-in SIM has a width of 25 mm, a height of 15 mm, a thickness the same as an ID-1 SIM and a feature for orientation. See figure A.1 in normative annex A for details of the dimensions of the card and the dimensions and location of the contacts.

Annexes A.1 and A.2 of ISO 7816-1 [24] do not apply to the Plug-in SIM.

Annex A of ISO 7816-2 [25] applies with the location of the reference points adapted to the smaller size. The three reference points P1, P2 and P3 measure 7,5 mm, 3,3 mm and 20,8 mm, respectively, from 0. The values in table A.1 of ISO 7816-2 [25] are replaced by the corresponding values of figure A.1.

4.2 Temperature range for card operation

The temperature range for full operational use shall be between -25°C and +70°C with occasional peaks of up to +85°C. "Occasional" means not more than 4 hours each time and not over 100 times during the life time of the card.

4.3 Contacts

4.3.1 Provision of contacts

ME: Contacting elements in the ME in positions C4 and C8 are optional, and are not used in the GSM application. They shall present a high impedance to the SIM card in the GSM application. If it is determined that the SIM is a multi-application ICC, then these contacts may be used. Contact C6 need not be provided for Plug-in SIMs.

SIM: Contacts C4 and C8 need not be provided by the SIM, but if they are provided, then they shall not be connected internally in the SIM if the SIM only contains the GSM application. Contact C6 shall not be bonded in the SIM for any function other than supplying Vpp.

4.3.2 Activation and deactivation

The ME shall connect, activate and deactivate the SIM in accordance with the Operating Procedures specified in ISO/IEC 7816-3 [26].

For any voltage level, monitored during the activation sequence, or during the deactivation sequence following soft power-down, the order of the contact activation/deactivation shall be respected.

NOTE 1: Soft Power switching is defined in GSM 02.07 [3].

NOTE 2: It is recommended that whenever possible the deactivation sequence defined in ISO/IEC 7816-3 [26] should be followed by the ME on all occasions when the ME is powered down.

If the SIM clock is already stopped and is not restarted, the ME is allowed to deactivate all the contacts in any order, provided that all signals reach low level before Vcc leaves high level. If the SIM clock is already stopped and is restarted before the deactivation sequence, then the deactivation sequence specified in ISO/IEC 7816-3 [26] subclause 5.4 shall be followed.

When Vpp is connected to Vcc, as allowed by GSM (see clause 5), then Vpp will be activated and deactivated with Vcc, at the time of the Vcc activation/deactivation, as given in the sequences of ISO/IEC 7816-3 [26] subclauses 5.1 and 5.4.

The voltage level of Vcc, used by GSM, differs from that specified in ISO/IEC 7816-3 [26]. Vcc is powered when it has a value between 4,5 V and 5,5 V.

4.3.3 Inactive contacts

The voltages on contacts C1, C2, C3, C6 and C7 of the ME shall be between 0 and ± 0,4 volts referenced to ground (C5) when the ME is switched off with the power source connected to the ME. The measurement equipment shall have a resistance of 50 kohms when measuring the voltage on C2, C3, C6 and C7. The resistance shall be 10 kohms when measuring the voltage on C1.

4.3.4 Contact pressure

The contact pressure shall be large enough to ensure reliable and continuous contact (e.g. to overcome oxidisation and to prevent interruption caused by vibration). The radius of any curvature of the contacting elements shall be greater than or equal to 0,8 mm over the contact area.

Under no circumstances may a contact force be greater than 0,5 N per contact.

Care shall be taken to avoid undue point pressure to the area of the SIM opposite to the contact area. Otherwise this may damage the components within the SIM.

4.4 Precedence

For Mobile Equipment, which accepts both an ID-1 SIM and a Plug-in SIM, the ID-1 SIM shall take precedence over the Plug-in SIM (see GSM 02.17 [6]).

4.5 Static Protection

Considering that the SIM is a CMOS device, the ME manufacturer shall take adequate precautions (in addition to the protection diodes inherent in the SIM) to safeguard the ME, SIM and SIM/ME interface from static discharges at all times, and particularly during SIM insertion into the ME.

5 Electronic signals and transmission protocols

Electronic signals and transmission protocols shall be in accordance with ISO/IEC 7816-3 [26] unless specified otherwise. The following additional requirements shall be applied to ensure proper operation in the GSM environment.

The choice of the transmission protocol(s), to be used to communicate between the SIM and the ME, shall at least include that specified and denoted by T=0 in ISO/IEC 7816-3 [26].

The values given in the tables hereafter are derived from ISO/IEC 7816-3 [26], subclause 4.2 with the following considerations:

- V_{OH} and V_{OL} always refer to the device (ME or SIM) which is driving the interface. V_{IH} and V_{IL} always refer to the device (ME or SIM) which is operating as a receiver on the interface.
- This convention is different to the one used in ISO/IEC 7816-3 [26], which specifically defines an ICC for which its current conventions apply. The following clauses define the specific core requirements for the SIM, which provide also the basis for Type Approval. For each state (V_{OH}, V_{IH}, V_{IL} and V_{OL}) a positive current is defined as flowing out of the entity (ME or SIM) in that state.

- The high current options of ISO/IEC 7816-3 [26] for V_{IH} and V_{OH} are not specified for the SIM as they apply to NMOS technology requirements. No realization of the SIM using NMOS is foreseen.

5.1 Supply voltage Vcc (contact C1)

The SIM shall be operated within the following limits:

Table 1: Electrical characteristics of Vcc under normal operating conditions

Symbol	Minimum	Maximum	Unit
Vcc	4,5	5,5	V
Icc		10	mA

The current consumption of the SIM shall not exceed the value given in table 1 during any state (including activation and deactivation as defined in subclause 4.3.2).

When the SIM is in idle state (see below) the current consumption of the card shall not exceed 200 µA at 1 MHz and 25°C. If clock stop mode is allowed, then the current consumption shall also not exceed 200 µA while the clock is stopped.

The ME shall source the maximum current requirements defined above. It shall also be able to counteract spikes in the current consumption of the card up to a maximum charge of 40 nAs with no more than 400 ns duration and an amplitude of at most 200 mA, ensuring that the supply voltage stays in the specified range.

NOTE: A possible solution would be to place a capacitor (e.g. 100 nF, ceramic) as close as possible to the contacting elements.

5.2 Reset (RST) (contact C2)

The ME shall operate the SIM within the following limits:

Table 2: Electrical characteristics of RST under normal operating conditions

Symbol	Conditions	Minimum	Maximum
V_{OH}	I_{OHmax} = +20 µA	Vcc-0,7	Vcc (note)
V_{OL}	I_{OLmax} = -200 µA	0V (note)	0,6 V
t_R t_F	$C_{out} = C_{in}$ = 30 pF		400 µs
NOTE: To allow for overshoot the voltage on RST shall remain between -0,3 V and Vcc+0,3 V during dynamic operation.			

5.3 Programming voltage Vpp (contact C6)

SIMs shall not require any programming voltage on Vpp. The ME need not provide contact C6. If the ME provides contact C6, then, in the case of the ID-1 SIM the same voltage shall be supplied on Vpp as on Vcc, while in the case of Plug-in SIMs the ME need not provide any voltage on C6. Contact C6 may be connected to Vcc in any ME but shall not be connected to ground.

5.4 Clock CLK (contact C3)

The SIM shall support 1 to 5 MHz. The clock shall be supplied by the ME. No "internal clock" SIMs shall be used.

If a frequency of 13/4 MHz is needed by the SIM to run the authentication procedure in the allotted time (see GSM 03.20 [11]), or to process an ENVELOPE command used for SIM Data Download, bit 2 of byte 1 in the file characteristics shall be set to 1. Otherwise a minimum frequency of 13/8 MHz may be used.

The duty cycle shall be between 40 % and 60 % of the period during stable operation.

The ME shall operate the SIM within the following limits:

Table 3: Electrical characteristics of CLK under normal operating conditions

Symbol	Conditions	Minimum	Maximum
V_{OH}	I_{OHmax} = +20 µA	0,7xVcc	Vcc (note)
V_{OL}	I_{OLmax} = -200 µA	0 V (note)	0,5 V
t_R t_F	$C_{out} = C_{in}$ = 30 pF		9 % of period with a maximum of 0,5 µs
NOTE: To allow for overshoot the voltage on CLK shall remain between -0,3 V and Vcc+0,3 V during dynamic operation.			

5.5 I/O (contact C7)

Table 4 defines the electrical characteristics of the I/O (contact C7). The values given in the table have the effect of defining the values of the pull-up resistor in the ME and the impedances of the drivers and receivers in the ME and SIM.

Table 4: Electrical characteristics of I/O under normal operating conditions

Symbol	Conditions	Minimum	Maximum
V_{IH}	I_{IHmax} = ± 20 µA (note 2)	0,7xVcc	Vcc+0,3 V
V_{IL}	I_{ILmax} = +1 mA	-0,3 V	0,8 V
V_{OH} (note 1)	I_{OHmax} = + 20µA	3,8 V	Vcc (note 3)
V_{OL}	I_{OLmax} = -1 mA	0 V (note 3)	0,4 V
t_R t_F	$C_{out} = C_{in}$ = 30 pF		1 µs
NOTE 1: It is assumed that a pull-up resistor is used in the interface device (recommended value: 20 kohms).			
NOTE 2: During static conditions (idle state) only the positive value can apply. Under dynamic operating conditions (transmission) short term voltage spikes on the I/O line may cause a current reversal.			
NOTE 3: To allow for overshoot the voltage on I/O shall remain between -0,3 V and Vcc+0,3 V during dynamic operation.			

5.6 States

There are two states for the SIM while the power supply is on:

- The SIM is in operating state when it executes a command. This state also includes transmission from and to the ME.
- The SIM is in idle state at any other time. It shall retain all pertinent data during this state.

The SIM may support a clock stop mode. The clock shall only be switched off subject to the conditions specified in the file characteristics (see clause 9).

Clock stop mode. An ME of Phase 2 or later shall wait at least 1 860 clock cycles after having received the last character, including the guard time (2 etu), of the response before it switches off the clock (if it is allowed to do so). It shall wait at least 744 clock cycles before it sends the first command after having started the clock.

To achieve phase compatibility, the following procedure shall be adhered to:

A SIM of Phase 2 or later shall always send the status information "normal ending of the command" after the successful interpretation of the command SLEEP received from a Phase 1 ME. An ME of Phase 2 or later shall not send a SLEEP command.

A Phase 1 ME shall wait at least 744 clock cycles after having received the compulsory acknowledgement SW1 SW2 of the SLEEP command before it switches off the clock (if it is allowed to do so). It shall wait at least 744 clock cycles before it sends the first command after having started the clock.

5.7 Baudrate

The initial baudrate (during ATR) shall be: (clock frequency)/372. Subsequent baudrate shall be: (clock frequency)/372 unless the PTS procedure has been successfully performed. In that case the negotiated baudrate shall be applied according to subclause 5.8.2.

5.8 Answer To Reset (ATR)

The ATR is information presented by the SIM to the ME at the beginning of the card session and gives operational requirements.

5.8.1 Structure and contents

The following table gives an explanation of the characters specified in ISO/IEC 7816-3 [26] and the requirements for their use in GSM. The answer to reset consists of at most 33 characters. The ME shall be able to receive interface characters for transmission protocols other than T=0, historical characters and a check byte, even if only T=0 is used by the ME.

Table 5: ATR

Character	Contents	sent by the card	a) evaluation by the ME b) reaction by the ME
1. Initial character TS	coding convention for all subsequent characters (direct or inverse convention)	always	a) always b) using appropriate convention
2. Format character T0	subsequent interface characters, number of historical characters	always	a) always b) identifying the subsequent characters accordingly
3. Interface character (global) TA1	parameters to calculate the work etu	optional	a) always if present b) if TA1 is not '11', PTS procedure shall be used (see subclause 5.8.2)
4. Interface character (global) TB1	parameters to calculate the programming voltage and current	optional	a) always if present b) if PI1 is not 0, then reject the SIM (in accordance with subclause 5.10)
5. Interface character (global) TC1	parameters to calculate the extra guardtime requested by the card; no extra guardtime is used to send characters from the card to the ME	optional	a) always if present b) if TC1 is neither 0 nor 255, then reject the SIM (in accordance with subclause 5.10); see the note after the table
6. Interface character TD1	protocol type; indicator for the presence of inter- face characters, specifying rules to be used for transmissions with the given protocol type	optional	a) always if present b) identifying the subsequent characters accordingly
7. Interface character (specific) TA2	not used for protocol T=0	optional	a) optional b) --------
8. Interface character (global) TB2	parameter to calculate the programming voltage	never	the allowed value of TB1 above defines that an external programming voltage is not applicable
9. Interface character (specific) TC2	parameters to calculate the work waiting time	optional	a) always if present b) using the work waiting time accordingly
10. Interface character TDi (i>1)	protocol type; indicator for the presence of interface characters, specifying rules to be used for transmissions with the given protocol type	optional	a) always if present b) identifying the subsequent characters accordingly

(continued)

Table 5 (concluded): ATR

Character	Contents	sent by the card	a) evaluation by the ME b) reaction by the ME
11. Interface character TAi, TBi, TCi (i>2)	characters which contain interface characters for other transmission protocols	optional	a) optional b) --------
12. Historical characters T1,...,TK	contents not specified in ISO/IEC	optional	a) optional b) --------
13. Check character TCK	check byte (exclusive -ORing)	not sent if only T=0 is indicated in the ATR; in all other cases TCK shall be sent	a) optional b) --------

NOTE: According to ISO/IEC 7816-3:1989/DAM2 (see annex D) N=255 indicates that the minimum delay is 12 etu for the asynchronous half-duplex character transmission protocol.

5.8.2 PTS procedure

Specifically related to the present document the PTS procedure according to ISO/IEC 7816-3 [26], clause 7, is applied, only if TA1 is not equal to '11', as follows:

a) for MEs only supporting default speed (F=372, D=1)

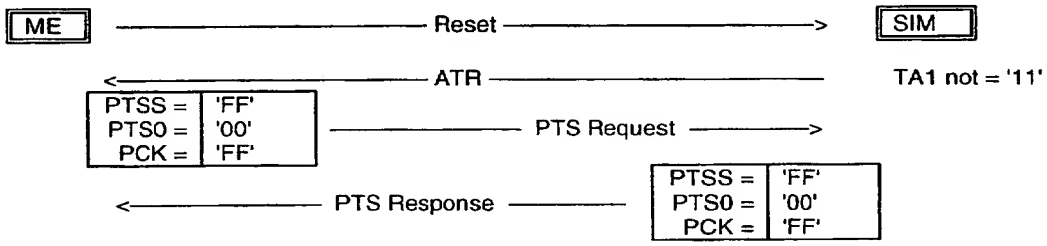


Figure 1: PTS procedure

PTS Request and PTS Response consist of the three (3) characters PTSS, PTSO and PCK of which PTSS is sent first.

After this procedure the protocol T=0 and the parameters F=372, D=1 and N=0 will be used.

b) for MEs only supporting enhanced speed (F=512, D=8)

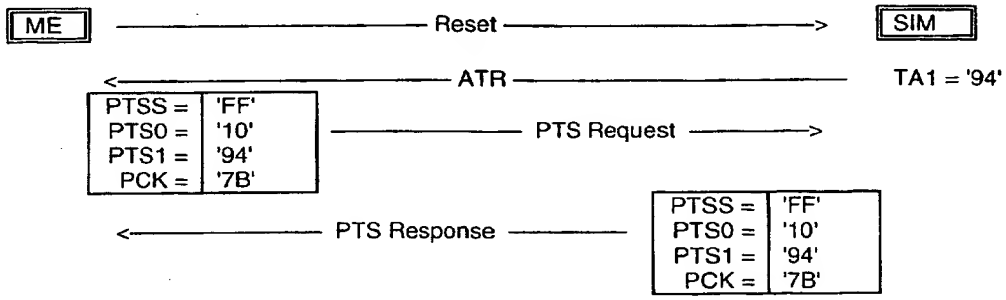


Figure 2: PTS procedure requesting enhanced speed values (F=512, D=8, see clause 5.8.3)

PTS Request and PTS Response consist of the four (4) characters PTSS, PTSO, PTS1 and PCK of which PTSS is sent first.

After this procedure the protocol T=0 and the parameters F=512, D=8 and N=0 will be used.

5.8.3 Speed enhancement

If speed enhancement is implemented, the ME and the SIM shall at least support F=512 and D=8 in addition to F=372 and D=1. However, other values may also be supported. If the ME requests PTS using values other than those above then the PTS procedure shall be initiated accordingly.

The SIM shall support the default value (F=372 and D=1). If the speed enhancement is supported by the SIM it is mandatory that F=512 and D=8 is supported. However, the value in TA1 may even indicate a faster speed (F=512 and D=16). The SIM may also support other values between the default value (F=372 and D=1) and the values indicated in TA1. The SIM shall offer the negotiable mode, to ensure backwards compatibility with existing MEs. In the negotiable mode the SIM will use default values even if other parameters are offered in the ATR if the PTS procedure is not initiated.

The ME shall support the default value (F=372 and D=1). If the speed enhancement is supported in the ME it is mandatory to support F=512 and D=8. The ME may additionally support other values.

If the SIM does not answer the PTS request within the initial waiting time the ME shall reset the SIM. After two failed PTS attempts using F=512 and D=8 or values indicated in TA1, (no PTS response from the SIM) the ME shall initiate PTS procedure using default values. If this also fails (no PTS response from the SIM) the ME may proceed using default values without requesting PTS.

If the SIM does not support the values requested by the ME, the SIM shall respond to the PTS request indicating the use of default values.

5.9 Bit/character duration and sampling time

The bit/character duration and sampling time specified in ISO/IEC 7816-3 [26], subclauses 6.1.1 and 6.1.2, are valid for all communications.

5.10 Error handling

Following receipt of an ATR, which is not in accordance with the present document, e.g. because of forbidden ATR characters or too few bytes being transmitted, the ME shall perform a Reset. The ME shall not reject the SIM until at least three consecutive wrong ATRs are received.

During the transmission of the ATR and the protocol type selection, the error detection and character repetition procedure specified in ISO/IEC 7816-3 [26], subclause 6.1.3, is optional for the ME. For the subsequent transmission on the basis of T=0 this procedure is mandatory for the ME.

For the SIM the error detection and character repetition procedure is mandatory for all communications.

6 Logical Model

This clause describes the logical structure for a SIM, the code associated with it, and the structure of files used.

6.1 General description

Figure 3 shows the general structural relationships which may exist between files. The files are organized in a hierarchical structure and are of one of three types as defined below. These files may be either administrative or application specific. The operating system handles the access to the data stored in different files.

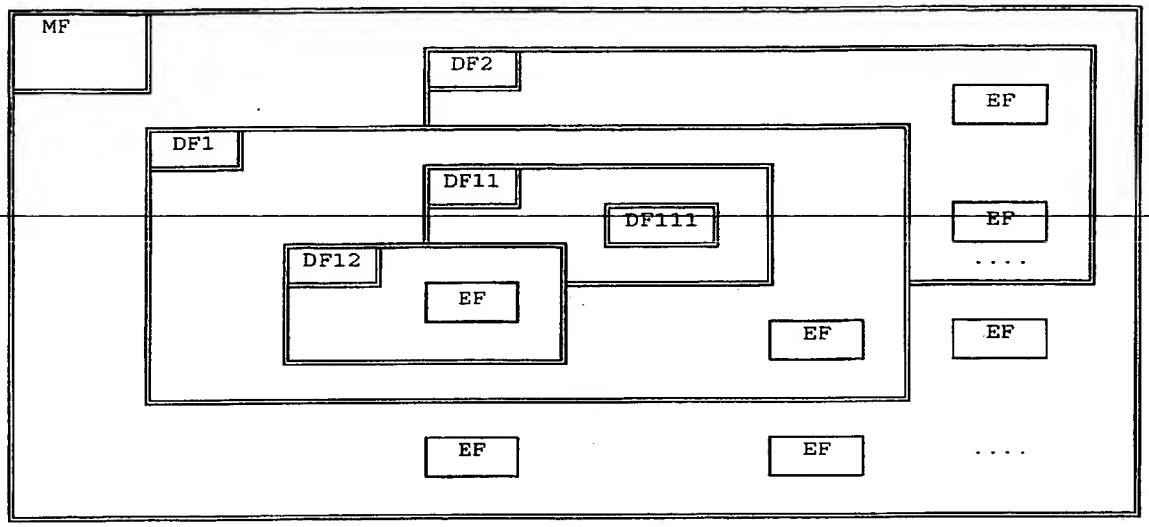


Figure 3: Organization of memory

Files are composed of a header, which is internally managed by the SIM, and optionally a body part. The information of the header is related to the structure and attributes of the file and may be obtained by using the commands GET RESPONSE or STATUS. This information is fixed during the administrative phase. The body part contains the data of the file.

6.2 File identifier

A file ID is used to address or identify each specific file. The file ID consists of two bytes and shall be coded in hexadecimal notation. They are specified in clause 10.

The first byte identifies the type of file, and for GSM is:

- '3F': Master File;
- '7F': 1st level Dedicated File;
- '5F': 2nd level Dedicated File;
- '2F': Elementary File under the Master File;
- '6F': Elementary File under a 1st level Dedicated File;
- '4F': Elementary File under 2nd level Dedicated File.

File IDs shall be subject to the following conditions:

- the file ID shall be assigned at the time of creation of the file concerned;
- no two files under the same parent shall have the same ID;
- a child and any parent, either immediate or remote in the hierarchy, e.g. grandparent, shall never have the same file ID.

In this way each file is uniquely identified.

6.3 Dedicated files

A Dedicated File (DF) is a functional grouping of files consisting of itself and all those files which contain this DF in their parental hierarchy (that is to say it consists of the DF and its complete "subtree"). A DF "consists" only of a header part.

Three 1st level DFs are defined in the present document:

- DF_{GSM} which contains the applications for both GSM and/or DCS 1800;
- DF_{IS41} which contains the applications for IS-41 as specified by ANSI T1P1;
- $DF_{TELECOM}$ which contains telecom service features.

All three files are immediate children of the Master File (MF) and may coexist on a multi-application card.

2nd level DFs are defined in the present document under DF_{GSM}.

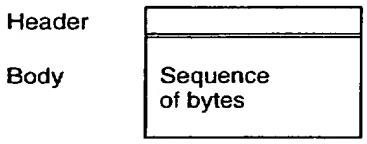
All 2nd level DFs are immediate children of the DF_{GSM} and may coexist on a multi-application card.

6.4 Elementary files

An Elementary File (EF) is composed of a header and a body part. The following three structures of an EF are used by GSM.

6.4.1 Transparent EF

An EF with a transparent structure consists of a sequence of bytes. When reading or updating, the sequence of bytes to be acted upon is referenced by a relative address (offset), which indicates the start position (in bytes), and the number of bytes to be read or updated. The first byte of a transparent EF has the relative address '00 00'. The total data length of the body of the EF is indicated in the header of the EF.



NOTE: This structure was previously referred to as "binary" in GSM.

Figure 4: Structure of a transparent EF

6.4.2 Linear fixed EF

An EF with linear fixed structure consists of a sequence of records all having the same (fixed) length. The first record is record number 1. The length of a record as well as this value multiplied by the number of records are indicated in the header of the EF.

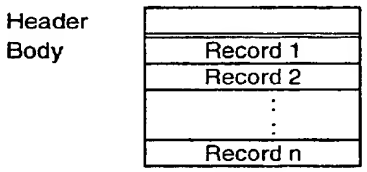


Figure 5: Structure of a linear fixed file

There are several methods to access records within an EF of this type:

- absolutely using the record number;
- when the record pointer is not set it shall be possible to perform an action on the first or the last record by using the NEXT or PREVIOUS mode;
- when the record pointer is set it shall be possible to perform an action on this record, the next record (unless the record pointer is set to the last record) or the previous record (unless the record pointer is set to the first record);
- by identifying a record using pattern seek starting:
  - forwards from the beginning of the file;
  - forwards from the record following the one at which the record pointer is set (unless the record pointer is set to the last record);
  - backwards from the end of the file;

- backwards from the record preceding the one at which the record pointer is set (unless the record pointer is set to the first record).

If an action following selection of a record is aborted, then the record pointer shall remain set at the record at which it was set prior to the action.

NOTE 1: It is not possible, at present, to have more than 255 records in a file of this type, and each record cannot be greater than 255 bytes.

NOTE 2: This structure was previously referred to as "formatted" in GSM.

6.4.3 Cyclic EF

Cyclic files are used for storing records in chronological order. When all records have been used for storage, then the next storage of data shall overwrite the oldest information.

An EF with a cyclic structure consists of a fixed number of records with the same (fixed) length. In this file structure there is a link between the last record (n) and the first record. When the record pointer is set to the last record n, then the next record is record 1. Similarly, when the record pointer is set to record 1, then the previous record is record n. The last updated record containing the newest data is record number 1, and the oldest data is held in record number n.

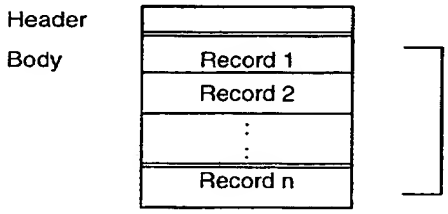


Figure 6: Structure of a cyclic file

For update operations only PREVIOUS record shall be used. For reading operations, the methods of addressing are Next, Previous, Current and Record Number.

After selection of a cyclic file (for either operation), the record pointer shall address the record updated or increased last. If an action following selection of a record is aborted, then the record pointer shall remain set at the record at which it was set prior to the action.

NOTE: It is not possible, at present, to have more than 255 records in a file of this type, and each record cannot be greater than 255 bytes.

6.5 Methods for selecting a file

After the Answer To Reset (ATR), the Master File (MF) is implicitly selected and becomes the Current Directory. Each file may then be selected by using the SELECT function in accordance with the following rules.

Selecting a DF or the MF sets the Current Directory. After such a selection there is no current EF. Selecting an EF sets the current EF and the Current Directory remains the DF or MF which is the parent of this EF. The current EF is always a child of the Current Directory.

Any application specific command shall only be operable if it is specific to the Current Directory.

The following files may be selected from the last selected file:

- any file which is an immediate child of the Current Directory;
- any DF which is an immediate child of the parent of the current DF;
- the parent of the Current Directory;
- the current DF;
- the MF.

This means in particular that a DF shall be selected prior to the selection of any of its EFs. All selections are made using the file ID.

The following figure gives the logical structure for the GSM application. GSM defines only two levels of DFs under the MF.

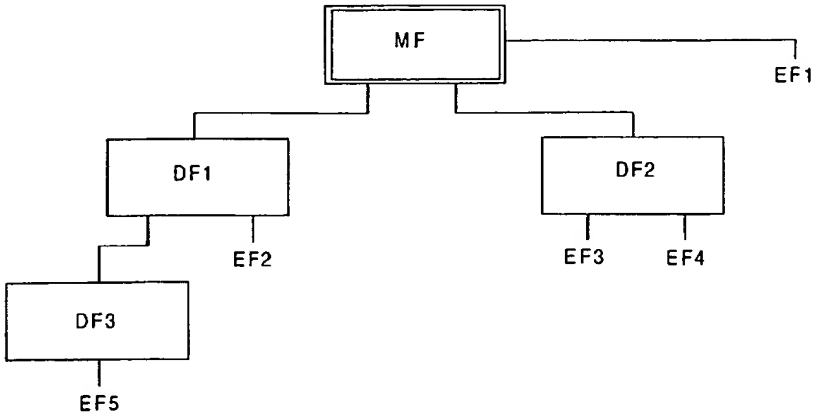


Figure 7: Logical structure

The following table gives the valid selections for GSM for the logical structure in figure 7. Reselection of the last selected file is also allowed but not shown.

Table 6: File selection

Last selected file	Valid Selections
MF	DF1, DF2, EF1
DF1	MF, DF2, DF3, EF2
DF2	MF, DF1, EF3, EF4
DF3	MF, DF1, EF5
EF1	MF, DF1, DF2
EF2	MF, DF1, DF2, DF3
EF3	MF, DF1, DF2, EF4
EF4	MF, DF1, DF2, EF3
EF5	MF, DF1, DF3

6.6 Reservation of file IDs

In addition to the identifiers used for the files specified in the present document, the following file IDs are reserved for use by GSM.

Dedicated Files:
- administrative use:
  '7F 4X', '5F1X', '5F2X'
- operational use:
  '7F 10' ($DF_{TELECOM}$), '7F 20' (DF_{GSM}), '7F 21' ($DF_{DCS1800}$), '7F 22' (DF_{IS41}), and '7F 2X', where X ranges from '3' to 'F'.
- reserved under '7F20':
  '5F30' ($DF_{IRIDIUM}$), '5F31' ($DF_{Globalstar}$), '5F32' (DF_{ICO}), '5F33' (DF_{ACeS}), '5F3X', where X ranges from '4' to 'F' for other MSS.
  '5F40'($DF_{PCS-1900}$), '5F4Y' where Y ranges from '1' to 'F' and,
  '5FYX' where Y ranges from '5' to 'F'.

Elementary files:
- administrative use:
  '6F XX' in the DFs '7F 4X'; '4F XX' in the DFs '5F 1X', '5F2X'
  '6F 1X' in the DFs '7F 10', '7F 20', '7F 21';
  '4F 1X' in all 2nd level DFs
  '2F 01', '2F EX' in the MF '3F 00';

- operational use:
  '6F 2X', '6F 3X', '6F 4X' in '7F 10' and '7F 2X';
  '4F YX', where Y ranges from '2' to 'F' in all 2nd level DFs.
  '2F 1X' in the MF '3F 00'.

In all the above, X ranges, unless otherwise stated, from '0' to 'F'.

7 Security features

The security aspects of GSM are described in the normative references GSM 02.09 [4] and GSM 03.20 [11]. This clause gives information related to security features supported by the SIM to enable the following:

- authentication of the subscriber identity to the network;
- data confidentiality over the radio interface;
- file access conditions.

7.1 Authentication and cipher key generation procedure

This subclause describes the authentication mechanism and cipher key generation which are invoked by the network. For the specification of the corresponding procedures across the SIM/ME interface see clause 11.

The network sends a Random Number (RAND) to the MS. The ME passes the RAND to the SIM in the command RUN GSM ALGORITHM. The SIM returns the values SRES and Kc to the ME which are derived using the algorithms and processes given below. The ME sends SRES to the network. The network compares this value with the value of SRES which it calculates for itself. The comparison of these SRES values provides the authentication. The value Kc is used by the ME in any future enciphered communications with the network until the next invocation of this mechanism.

A subscriber authentication key Ki is used in this procedure. This key Ki has a length of 128 bits and is stored within the SIM for use in the algorithms described below.

7.2 Algorithms and processes

The names and parameters of the algorithms supported by the SIM are defined in GSM 03.20 [11]. These are:

- Algorithm A3 to authenticate the MS to the network;
- Algorithm A8 to generate the encryption key.

These algorithms may exist either discretely or combined (into A38) within the SIM. In either case the output on the SIM/ME interface is 12 bytes. The inputs to both A3 and A8, or A38, are Ki (128 bits) internally derived in the SIM, and RAND (128 bits) across the SIM/ME interface. The output is SRES (32 bits)/Kc (64 bits) the coding of which is defined in the command RUN GSM ALGORITHM in clause 9.

7.3 File access conditions

Every file has its own specific access condition for each command. The relevant access condition of the last selected file shall be fulfilled before the requested action can take place.

For each file:

- the access conditions for the commands READ and SEEK are identical;
- the access conditions for the commands SELECT and STATUS are ALWays.

No file access conditions are currently assigned by GSM to the MF and the DFs.

The access condition levels are defined in the following table:

Table 7: Access condition level coding

Level	Access Condition
0	ALWays
1	CHV1
2	CHV2
3	Reserved for GSM Future Use
4 to 14	ADM
15	NEVer

The meaning of the file access conditions is as follows:

ALWAYS: The action can be performed without any restriction;

CHV1 (card holder verification 1): The action shall only be possible if one of the following three conditions is fulfilled:

- a correct CHV1 value has already been presented to the SIM during the current session;
- the CHV1 enabled/disabled indicator is set to "disabled";
  NOTE: Some Phase 1 and Phase 2 SIMs do not necessarily grant access when CHV1 is "disabled" and "blocked".
- UNBLOCK CHV1 has been successfully performed during the current session;

CHV2: The action shall only be possible if one of the following two conditions is fulfilled:

- a correct CHV2 value has already been presented to the SIM during the current session;
- UNBLOCK CHV2 has been successfully performed during the current session;

ADM: Allocation of these levels and the respective requirements for their fulfilment are the responsibility of the appropriate administrative authority

The definition of access condition ADM does not preclude the administrative authority from using ALW, CHV1, CHV2 and NEV if required.

NEVER: The action cannot be performed over the SIM/ME interface. The SIM may perform the action internally.

Condition levels are not hierarchical. For instance, correct presentation of CHV2 does not allow actions to be performed which require presentation of CHV1. A condition level which has been satisfied remains valid until the end of the GSM session as long as the corresponding secret code remains unblocked, i.e. after three consecutive wrong attempts, not necessarily in the same card session, the access rights previously granted by this secret code are lost immediately. A satisfied CHV condition level applies to both DF_{GSM} and $DF_{TELECOM}$.

The ME shall determine whether CHV2 is available by using the response to the STATUS command. If CHV2 is "not initialized" then CHV2 commands, e.g. VERIFY CHV2, shall not be executable.

8 Description of the functions

This clause gives a functional description of the commands and their respective responses. Associated status conditions, error codes and their corresponding coding are specified in clause 9.

It shall be mandatory for all cards complying with the present document to support all functions described in the present document. The command GET RESPONSE which is needed for the protocol T=0 is specified in clause 9.

The following table lists the file types and structures together with the functions which may act on them during a GSM session. These are indicated by an asterisk (*).

Table 8: Functions on files in GSM session

	File				
Function	**MF**	**DF**	**EF transparent**	**EF linear fixed**	**EF cyclic**
SELECT	*	*	*	*	*
STATUS	*	*	*	*	*
READ BINARY			*		
UPDATE BINARY			*		
READ RECORD				*	*
UPDATE RECORD				*	*
SEEK				*	
INCREASE					*
INVALIDATE			*	*	*
REHABILITATE			*	*	*

8.1 SELECT

This function selects a file according to the methods described in clause 6. After a successful selection the record pointer in a linear fixed file is undefined. The record pointer in a cyclic file shall address the last record which has been updated or increased.

Input:
- file ID.

Output:
- if the selected file is the MF or a DF:
  file ID, total memory space available, CHV enabled/disabled indicator, CHV status and other GSM specific data;
- if the selected file is an EF:
  file ID, file size, access conditions, invalidated/not invalidated indicator, structure of EF and length of the records in case of linear fixed structure or cyclic structure.

8.2 STATUS

This function returns information concerning the current directory. A current EF is not affected by the STATUS function. It is also used to give an opportunity for a pro-active SIM to indicate that the SIM wants to issue a SIM Application Toolkit command to the ME.

Input:
- none.

Output:
- file ID, total memory space available, CHV enabled/disabled indicator, CHV status and other GSM specific data (identical to SELECT above).

8.3 READ BINARY

This function reads a string of bytes from the current transparent EF. This function shall only be performed if the READ access condition for this EF is satisfied.

Input:
- relative address and the length of the string.

Output:
- string of bytes.

8.4 UPDATE BINARY

This function updates the current transparent EF with a string of bytes. This function shall only be performed if the UPDATE access condition for this EF is satisfied. An update can be considered as a replacement of the string already present in the EF by the string given in the update command.

Input:
- relative address and the length of the string;
- string of bytes.

Output:
- none.

8.5 READ RECORD

This function reads one complete record in the current linear fixed or cyclic EF. The record to be read is described by the modes below. This function shall only be performed if the READ access condition for this EF is satisfied. The record pointer shall not be changed by an unsuccessful READ RECORD function.

Four modes are defined:

CURRENT: The current record is read. The record pointer is not affected.

ABSOLUTE: The record given by the record number is read. The record pointer is not affected.

NEXT: The record pointer is incremented before the READ RECORD function is performed and the pointed record is read. If the record pointer has not been previously set within the selected EF, then READ RECORD (next) shall read the first record and set the record pointer to this record.

If the record pointer addresses the last record in a linear fixed EF, READ RECORD (next) shall not cause the record pointer to be changed, and no data shall be read.

If the record pointer addresses the last record in a cyclic EF, READ RECORD (next) shall set the record pointer to the first record in this EF and this record shall be read.

PREVIOUS: The record pointer is decremented before the READ RECORD function is performed and the pointed record is read. If the record pointer has not been previously set within the selected EF, then READ RECORD (previous) shall read the last record and set the record pointer to this record.

If the record pointer addresses the first record in a linear fixed EF, READ RECORD (previous) shall not cause the record pointer to be changed, and no data shall be read.

If the record pointer addresses the first record in a cyclic EF, READ RECORD (previous) shall set the record pointer to the last record in this EF and this record shall be read.

Input:
- mode, record number (absolute mode only) and the length of the record.

Output:
- the record.

8.6 UPDATE RECORD

This function updates one complete record in the current linear fixed or cyclic EF. This function shall only be performed if the UPDATE access condition for this EF is satisfied. The UPDATE can be considered as a replacement of the relevant record data of the EF by the record data given in the command. The record pointer shall not be changed by an unsuccessful UPDATE RECORD function.

The record to be updated is described by the modes below. Four modes are defined of which only PREVIOUS is allowed for cyclic files:

CURRENT: The current record is updated. The record pointer is not affected.

ABSOLUTE: The record given by the record number is updated. The record pointer is not affected.

NEXT: The record pointer is incremented before the UPDATE RECORD function is performed and the pointed record is updated. If the record pointer has not been previously set within the selected EF, then UPDATE RECORD (next) shall set the record pointer to the first record in this EF and this record shall be updated. If the record pointer addresses the last record in a linear fixed EF, UPDATE RECORD (next) shall not cause the record pointer to be changed, and no record shall be updated.

PREVIOUS: For a linear fixed EF the record pointer is decremented before the UPDATE RECORD function is performed and the pointed record is updated. If the record pointer has not been previously set within the selected EF, then UPDATE RECORD (previous) shall set the record pointer to the last record in this EF and this record shall be updated. If the record pointer addresses the first record in a linear fixed EF, UPDATE RECORD (previous) shall not cause the record pointer to be changed, and no record shall be updated.

For a cyclic EF the record containing the oldest data is updated, the record pointer is set to this record and this record becomes record number 1.

Input:
- mode, record number (absolute mode only) and the length of the record;
- the data used for updating the record.

Output:
- none.

8.7 SEEK

This function searches through the current linear fixed EF to find a record starting with the given pattern. This function shall only be performed if the READ access condition for this EF is satisfied. Two types of SEEK are defined:

Type 1 The record pointer is set to the record containing the pattern, no output is available.

Type 2 The record pointer is set to the record containing the pattern, the output is the record number.

NOTE: A Phase 1 SIM only executes type 1 of the SEEK function.

The SIM shall be able to accept any pattern length from 1 to 16 bytes inclusive. The length of the pattern shall not exceed the record length.

Four modes are defined:

- from the beginning forwards;
- from the end backwards;
- from the next location forwards;
- from the previous location backwards.

If the record pointer has not been previously set (its status is undefined) within the selected linear fixed EF, then the search begins:

- with the first record in the case of SEEK from the next location forwards; or
- with the last record in the case of SEEK from the previous location backwards.

After a successful SEEK, the record pointer is set to the record in which the pattern was found. The record pointer shall not be changed by an unsuccessful SEEK function.

Input:
- type and mode;
- pattern;
- length of the pattern.

Output:
- type 1: none;
- type 2: status/record number

8.8 INCREASE

This function adds the value given by the ME to the value of the last increased/updated record of the current cyclic EF, and stores the result into the oldest record. The record pointer is set to this record and this record becomes record number 1. This function shall be used only if this EF has an INCREASE access condition assigned and this condition is fulfilled (see bytes 8 and 10 in the response parameters/data of the current EF, clause 9). The SIM shall not perform the increase if the result would exceed the maximum value of the record (represented by all bytes set to 'FF').

Input:

- the value to be added.

Output:
- value of the increased record;
- value which has been added.

8.9 VERIFY CHV

This function verifies the CHV presented by the ME by comparing it with the relevant one stored in the SIM. The verification process is subject to the following conditions being fulfilled:

- CHV is not disabled;
- CHV is not blocked.

If the access condition for a function to be performed on the last selected file is CHV1 or CHV2, then a successful verification of the relevant CHV is required prior to the use of the function on this file unless the CHV is disabled.

If the CHV presented is correct, the number of remaining CHV attempts for that CHV shall be reset to its initial value 3.

If the CHV presented is false, the number of remaining CHV attempts for that CHV shall be decremented. After 3 consecutive false CHV presentations, not necessarily in the same card session, the respective CHV shall be blocked and the access condition can never be fulfilled until the UNBLOCK CHV function has been successfully performed on the respective CHV.

Input:
- indication CHV1/CHV2, CHV.

Output:
- none.

8.10 CHANGE CHV

This function assigns a new value to the relevant CHV subject to the following conditions being fulfilled:

- CHV is not disabled;
- CHV is not blocked.

The old and new CHV shall be presented.

If the old CHV presented is correct, the number of remaining CHV attempts for that CHV shall be reset to its initial value 3 and the new value for the CHV becomes valid.

If the old CHV presented is false, the number of remaining CHV attempts for that CHV shall be decremented and the value of the CHV is unchanged. After 3 consecutive false CHV presentations, not necessarily in the same card session, the respective CHV shall be blocked and the access condition can never be fulfilled until the UNBLOCK CHV function has been performed successfully on the respective CHV.

Input:
- indication CHV1/CHV2, old CHV, new CHV.

Output:
- none.

8.11 DISABLE CHV

This function may only be applied to CHV1. The successful execution of this function has the effect that files protected by CHV1 are now accessible as if they were marked "ALWAYS". The function DISABLE CHV shall not be executed by the SIM when CHV1 is already disabled or blocked.

If the CHV1 presented is correct, the number of remaining CHV1 attempts shall be reset to its initial value 3 and CHV1 shall be disabled.

If the CHV1 presented is false, the number of remaining CHV1 attempts shall be decremented and CHV1 remains enabled. After 3 consecutive false CHV1 presentations, not necessarily in the same card session, CHV1 shall be blocked and the access condition can never be fulfilled until the UNBLOCK CHV function has been successfully performed on CHV1.

Input:
- CHV1.

Output:
- none.

8.12 ENABLE CHV

This function may only be applied to CHV1. It is the reverse function of DISABLE CHV. The function ENABLE CHV shall not be executed by the SIM when CHV1 is already enabled or blocked.

If the CHV1 presented is correct, the number of remaining CHV1 attempts shall be reset to its initial value 3 and CHV1 shall be enabled.

If the CHV1 presented is false, the number of remaining CHV1 attempts shall be decremented and CHV1 remains disabled. After 3 consecutive false CHV1 presentations, not necessarily in the same card session, CHV1 shall be blocked and may optionally be set to "enabled". Once blocked, the CHV1 can only be unblocked using the UNBLOCK CHV function. If the CHV1 is blocked and "disabled", the access condition shall remain granted. If the CHV1 is blocked and "enabled", the access condition can never be fulfilled until the UNBLOCK CHV function has been successfully performed on CHV1.

Input:
- CHV1.

Output:
- none.

8.13 UNBLOCK CHV

This function unblocks a CHV which has been blocked by 3 consecutive wrong CHV presentations. This function may be performed whether or not the relevant CHV is blocked.

If the UNBLOCK CHV presented is correct, the value of the CHV, presented together with the UNBLOCK CHV, is assigned to that CHV, the number of remaining UNBLOCK CHV attempts for that UNBLOCK CHV is reset to its initial value 10 and the number of remaining CHV attempts for that CHV is reset to its initial value 3. After a successful unblocking attempt the CHV is enabled and the relevant access condition level is satisfied.

If the presented UNBLOCK CHV is false, the number of remaining UNBLOCK CHV attempts for that UNBLOCK CHV shall be decremented. After 10 consecutive false UNBLOCK CHV presentations, not necessarily in the same card session, the respective UNBLOCK CHV shall be blocked. A false UNBLOCK CHV shall have no effect on the status of the respective CHV itself.

Input:
- indication CHV1/CHV2, the UNBLOCK CHV and the new CHV.

Output:
- none.

8.14 INVALIDATE

This function invalidates the current EF. After an INVALIDATE function the respective flag in the file status shall be changed accordingly. This function shall only be performed if the INVALIDATE access condition for the current EF is satisfied.

An invalidated file shall no longer be available within the application for any function except for the SELECT and the REHABILITATE functions unless the file status of the EF indicates that READ and UPDATE may also be performed.

Input:

- none.

Output:

- none.

8.15 REHABILITATE

This function rehabilitates the invalidated current EF. After a REHABILITATE function the respective flag in the file status shall be changed accordingly. This function shall only be performed if the REHABILITATE access condition for the current EF is satisfied.

If BDN is enabled (see clause 11.5.1) then the REHABILITATE function shall not rehabilitate the invalidated EF_{IMSI} and EF_{LOCI} until the PROFILE DOWNLOAD procedure is performed indicating that the ME supports the "Call control by SIM" facility (see GSM 11.14 [27]).

Input:

- none.

Output:

- none.

8.16 RUN GSM ALGORITHM

This function is used during the procedure for authenticating the SIM to a GSM network and to calculate a cipher key. The card runs the specified algorithms A3 and A8 using a 16 byte random number and the subscriber authentication key Ki, which is stored in the SIM. The function returns the calculated response SRES and the cipher key Kc.

The function shall not be executable unless DF_{GSM} or any sub-directory under DF_{GSM} has been selected as the Current Directory and a successful CHV1 verification procedure has been performed (see 11.3.1).

Input:

- RAND.

Output:

- SRES, Kc.

The contents of Kc shall be presented to algorithm A5 by the ME in its full 64 bit format as delivered by the SIM.

8.17 SLEEP

This is an obsolete GSM function which was issued by Phase 1 MEs. The function shall not be used by an ME of Phase 2 or later.

8.18 TERMINAL PROFILE

This function is used by the ME to transmit to the SIM its capabilities concerning the SIM Application Toolkit functionality.

Input:

- terminal profile.

Output:

- none.

8.19 ENVELOPE

This function is used to transfer data to the SIM Application Toolkit applications in the SIM.

Input:

- data string.

Output:

- The structure of the data is defined in GSM 11.14 [27].

8.20 FETCH

This function is used to transfer an Application Toolkit command from the SIM to the ME.

Input:
- none.

Output:
- data string containing an SIM Application Toolkit command for the ME.

8.21 TERMINAL RESPONSE

This function is used to transfer from the ME to the SIM the response to a previously fetched SIM Application Toolkit command.

Input:
- data string containing the response.

Output:
- none.

9 Description of the commands

This clause states the general principles for mapping the functions described in clause 8 onto Application Protocol Data Units which are used by the transmission protocol.

9.1 Mapping principles

An APDU can be a command APDU or a response APDU.

A command APDU has the following general format:

CLA	INS	P1	P2	P3	Data

The response APDU has the following general format:

Data	SW1	SW2

An APDU is transported by the T=0 transmission protocol without any change. Other protocols might embed an APDU into their own transport structure (ISO/IEC 7816-3 [26]).

The bytes have the following meaning:

- CLA is the class of instruction (ISO/IEC 7816-3 [26]), 'A0' is used in the GSM application;
- INS is the instruction code (ISO/IEC 7816-3 [26]) as defined in this subclause for each command;
- P1, P2, P3 are parameters for the instruction. They are specified in table 9. 'FF' is a valid value for P1, P2 and P3. P3 gives the length of the data element. P3='00' introduces a 256 byte data transfer from the SIM in an outgoing data transfer command (response direction). In an ingoing data transfer command (command direction), P3='00' introduces no transfer of data.
- SW1 and SW2 are the status words indicating the successful or unsuccessful outcome of the command.

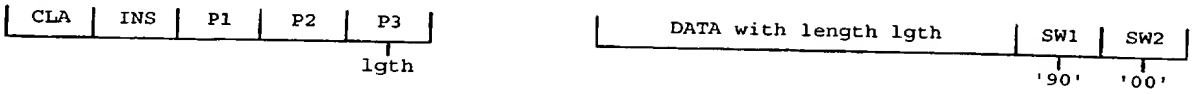
For some of the functions described in clause 8 it is necessary for T=0 to use a supplementary transport service command (GET RESPONSE) to obtain the output data. For example, the SELECT function needs the following two commands:

- the first command (SELECT) has both parameters and data serving as input for the function;
- the second command (GET RESPONSE) has a parameter indicating the length of the data to be returned.

If the length of the response data is not known beforehand, then its correct length may be obtained by applying the first command and interpreting the status words. SW1 shall be '9F' and SW2 shall give the total length of the data. Other status words may be present in case of an error. The various cases are:

Case 1: No input / No output

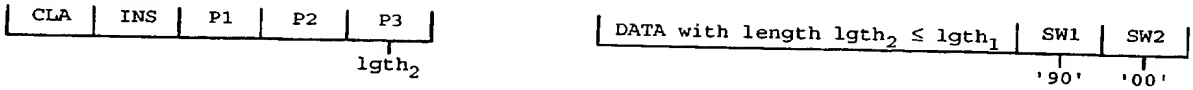
Case 2: No input / Output of known length



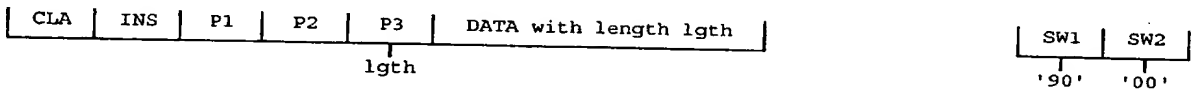
NOTE: lgth='00' causes a data transfer of 256 bytes.

Case 3: No Input / Output of unknown length

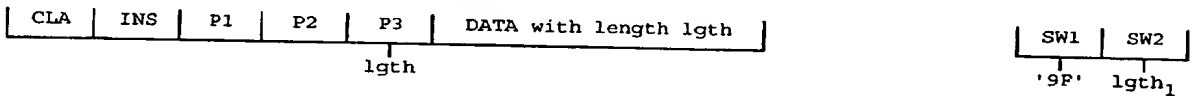
GET RESPONSE



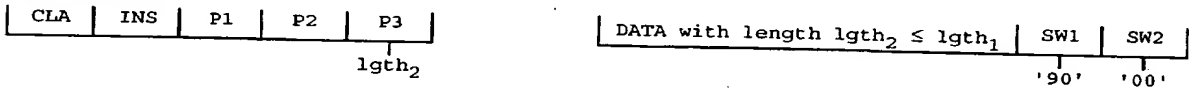
Case 4: Input / No output



Case 5: Input / Output of known or unknown length



GET RESPONSE



For cases 3 and 5, when SW1/SW2 indicates there is response data (i.e. SW1/SW2 = '9FXX'), then, if the ME requires to get this response data, it shall send a GET RESPONSE command as described in the relevant case above.

For case 5, in case of an ENVELOPE for SIM data download, SW1/SW2 may also indicate there is response data with the value '9EXX', and the ME shall then send a GET RESPONSE command to get this response data.

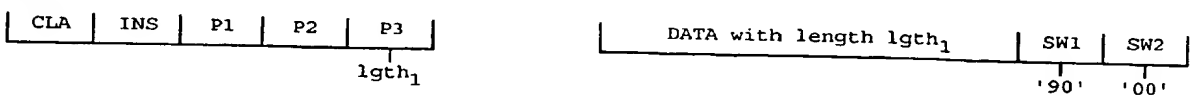
If the GSM application is one of several applications in a multi-application card, other commands with CLA not equal to 'A0' may be sent by the terminal. This shall not influence the state of the GSM application.

The following diagrams show how the five cases of transmission protocol identified in the above diagrams can all be used to send pro-active SIM commands. For further information on the diagrams below see GSM 11.14 [27].

Case 1: No input / "OK" response with no output, plus additional command from SIM

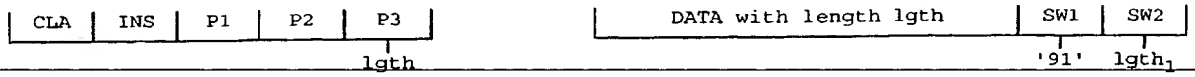
[Possible "normal GSM operation" command/response pairs]

FETCH



NOTE: $lgth_1$='00' causes a data transfer of 256 bytes.

Case 2: No input / "OK" response with data of known length, plus additional command from SIM



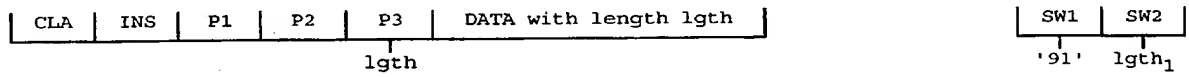
[Possible "normal GSM operation" command/response pairs]

NOTE: lgth='00' causes a data transfer of 256 bytes. The same applies to $lgth_1$.

Case 3: No Input / "OK" response with data of unknown length, plus additional command from SIM

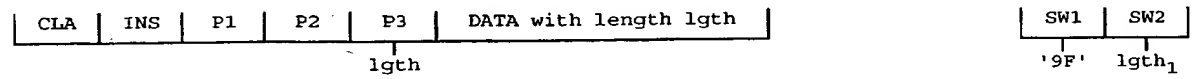
[Possible "normal GSM operation" command/response pairs]

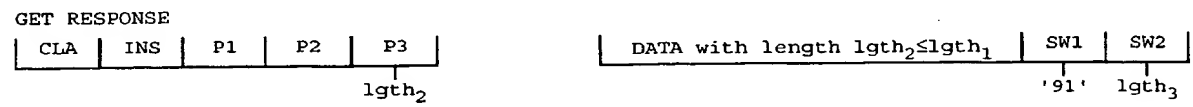
Case 4: Input / "OK" response with no output data, plus additional command from SIM



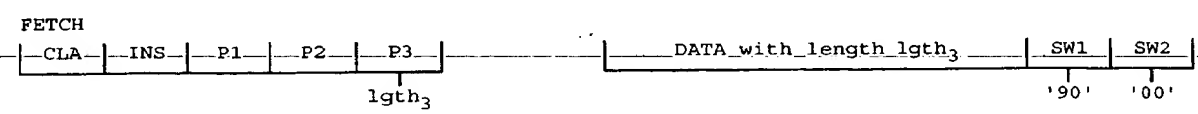
[Possible "normal GSM operation" command/response pairs]

Case 5: Input / "OK" response with data of known or unknown length, plus additional command from SIM





[Possible "normal GSM operation" command/response pairs]



9.2 Coding of the commands

Table 9 below gives the coding of the commands. The direction of the data is indicated by (S) and (R), where (S) stands for data sent by the ME while (R) stands for data received by the ME. Offset is coded on 2 bytes where P1 gives the high order byte and P2 the low order byte. '00 00' means no offset and reading/updating starts with the first byte while an offset of '00 01' means that reading/updating starts with the second byte.

In addition to the instruction codes specified in table 9 the following codes are reserved:

GSM operational phase:
'1X' with X even, from X=6 to X=E.

Administrative management phase:
'2A', 'D0', 'D2', 'DE', 'C4', 'C6', 'C8', 'CA', 'CC', 'B4', 'B6', 'B8', 'BA' and 'BC'.

Table 9: Coding of the commands

COMMAND	INS	P1	P2	P3	S/R
SELECT	'A4'	'00'	'00'	'02'	S/R
STATUS	'F2'	'00'	'00'	lgth	R
READ BINARY	'B0'	offset high	offset low	lgth	R
UPDATE BINARY	'D6'	offset high	offset low	lgth	S
READ RECORD	'B2'	rec No.	mode	lgth	R
UPDATE RECORD	'DC'	rec No.	mode	lgth	S
SEEK	'A2'	'00'	type/mode	lgth	S/R
INCREASE	'32'	'00'	'00'	'03'	S/R
VERIFY CHV	'20'	'00'	CHV No.	'08'	S
CHANGE CHV	'24'	'00'	CHV No.	'10'	S
DISABLE CHV	'26'	'00'	'01'	'08'	S
ENABLE CHV	'28'	'00'	'01'	'08'	S
UNBLOCK CHV	'2C'	'00'	see note	'10'	S
INVALIDATE	'04'	'00'	'00'	'00'	-
REHABILITATE	'44'	'00'	'00'	'00'	-
RUN GSM ALGORITHM	'88'	'00'	'00'	'10'	S/R
SLEEP	'FA'	'00'	'00'	'00'	-
GET RESPONSE	'C0'	'00'	'00'	lgth	R
TERMINAL PROFILE	'10'	'00'	'00'	lgth	S
ENVELOPE	'C2'	'00'	'00'	lgth	S/R
FETCH	'12'	'00'	'00'	lgth	R
TERMINAL RESPONSE	'14'	'00'	'00'	lgth	S

NOTE: If the UNBLOCK CHV command applies to CHV1 then P2 is coded '00'; if it applies to CHV2 then P2 is coded '02'.

Definitions and codings used in the response parameters/data of the commands are given in subclause 9.3.

9.2.1 SELECT

COMMAND	CLASS	INS	P1	P2	P3
SELECT	'A0'	'A4'	'00'	'00'	'02'

Command parameters/data:

Byte(s)	Description	Length
1 - 2	File ID	2

Response parameters/data in case of an MF or DF:

Byte(s)	Description	Length
1 - 2	RFU	2
3 - 4	Total amount of memory of the selected directory which is not allocated to any of the DFs or EFs under the selected directory	2
5 - 6	File ID	2
7	Type of file (see subclause 9.3)	1
8 - 12	RFU	5
13	Length of the following data (byte 14 to the end)	1
14 - 34	GSM specific data	21

GSM specific data:

Byte(s)	Description	Length
14	File characteristics (see detail 1)	1
15	Number of DFs which are a direct child of the current directory	1
16	Number of EFs which are a direct child of the current directory	1
17	Number of CHVs, UNBLOCK CHVs and administrative codes	1
18	RFU	1
19	CHV1 status (see detail 2)	1
20	UNBLOCK CHV1 status (see detail 2)	1
21	CHV2 status (see detail 2)	1
22	UNBLOCK CHV2 status (see detail 2)	1
23	RFU	1
24 - 34	Reserved for the administrative management	0 ≤ lgth ≤ 11

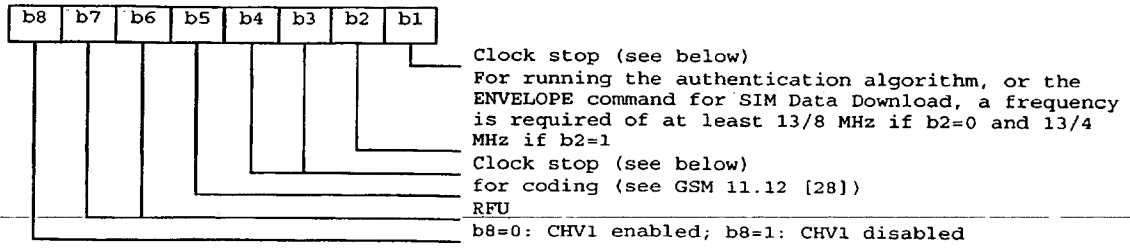
Bytes 1 - 22 are mandatory and shall be returned by the SIM. Bytes 23 and following are optional and may not be returned by the SIM.

NOTE 1: Byte 35 and following are RFU.

NOTE 2: The STATUS information of the MF, DF_{GSM} and $DF_{TELECOM}$ provide some identical application specific data, e.g. CHV status. On a multi-application card the MF should not contain any application specific data. Such data is obtained by terminals from the specific application directories. ME manufacturers should take this into account and therefore not use application specific data which may exist in the MF of a mono-application SIM.

Similarly, the VERIFY CHV command should not be executed in the MF but in the relevant application directory (e.g. DF_{GSM}).

Detail 1: File characteristics



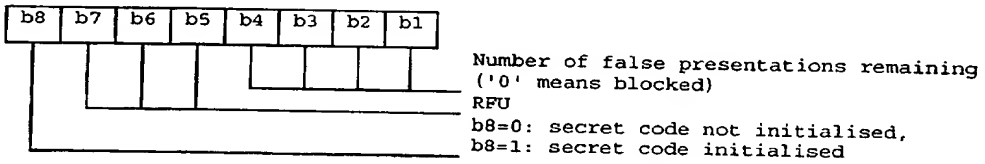
The coding of the conditions for stopping the clock is as follows:

Bit b1	Bit b3	Bit b4	
1	0	0	clock stop allowed, no preferred level
1	1	0	clock stop allowed, high level preferred
1	0	1	clock stop allowed, low level preferred
0	0	0	clock stop not allowed
0	1	0	clock stop not allowed, unless at high level
0	0	1	clock stop not allowed, unless at low level

If bit b1 (column 1) is coded 1, stopping the clock is allowed at high or low level. In this case columns 2 (bit b3) and 3 (bit b4) give information about the preferred level (high or low, respectively) at which the clock may be stopped.

If bit b1 is coded 0, the clock may be stopped only if the mandatory condition in column 2 (b3=1, i.e. stop at high level) or column 3 (b4=1, i.e. stop at low level) is fulfilled. If all 3 bits are coded 0, then the clock shall not be stopped.

Detail 2: Status byte of a secret code



Response parameters/data in case of an EF:

Byte(s)	Description	Length
1 - 2	RFU	2
3 - 4	File size (for transparent EF: the length of the body part of the EF) (for linear fixed or cyclic EF: record length multiplied by the number of records of the EF)	2
5 - 6	File ID	2
7	Type of file (see 9.3)	1
8	see detail 3	1
9 - 11	Access conditions (see 9.3)	3
12	File status (see 9.3)	1
13	Length of the following data (byte 14 to the end)	1
14	Structure of EF (see 9.3)	1
15	Length of a record (see detail 4)	1
16 and following	RFU	-

Bytes 1-14 are mandatory and shall be returned by the SIM.
Byte 15 is mandatory in case of linear fixed or cyclic EFs and shall be returned by the SIM.
Byte 15 is optional in case of transparent EFs and may not be returned by the SIM.
Byte 16 and following (when defined) are optional and may not be returned by the SIM.

Detail 3: Byte 8

For transparent and linear fixed EFs this byte is RFU. For a cyclic EF all bits except bit 7 are RFU; b7=1 indicates that the INCREASE command is allowed on the selected cyclic file.

Detail 4: Byte 15

For cyclic and linear fixed EFs this byte denotes the length of a record. For a transparent EF, this byte shall be coded '00', if this byte is sent by the SIM.

9.2.2 STATUS

COMMAND	CLASS	INS	P1	P2	P3
STATUS	'A0'	'F2'	'00'	'00'	lgth

The response parameters/data are identical to the response parameters/data of the SELECT command in case of an MF or DF.

9.2.3 READ BINARY

COMMAND	CLASS	INS	P1	P2	P3
READ BINARY	'A0'	'B0'	offset high	offset low	lgth

Response parameters/data:

Byte(s)	Description	Length
1 - lgth	Data to be read	lgth

9.2.4 UPDATE BINARY

COMMAND	CLASS	INS	P1	P2	P3
UPDATE BINARY	'A0'	'D6'	offset high	offset low	lgth

Command parameters/data:

Byte(s)	Description	Length
1 - lgth	Data	lgth

9.2.5 READ RECORD

COMMAND	CLASS	INS	P1	P2	P3
READ RECORD	'A0'	'B2'	Rec.No.	Mode	lgth

Parameter P2 specifies the mode:

- '02' = next record;
- '03' = previous record;
- '04' = absolute mode/current mode, the record number is given in P1 with P1='00' denoting the current record.

For the modes "next" and "previous" P1 has no significance and shall be set to '00' by the ME. To ensure phase compatibility between Phase 2 SIMs and Phase 1 MEs, the SIM shall not interpret the value given by the ME.

Response parameters/data:

Byte(s)	Description	Length
1 - lgth	The data of the record	lgth

9.2.6 UPDATE RECORD

COMMAND	CLASS	INS	P1	P2	P3
UPDATE RECORD	'A0'	'DC'	Rec.No.	Mode	lgth

Parameter P2 specifies the mode:

- '02' = next record;
- '03' = previous record;
- '04' = absolute mode/current mode; the record number is given in P1 with P1='00' denoting the current record.

For the modes "next" and "previous" P1 has no significance and shall be set to '00' by the ME. To ensure phase compatibility between Phase 2 SIMs and Phase 1 MEs, the SIM shall not interpret the value given by the ME.

Command parameters/data:

Byte(s)	Description	Length
1 - lgth	Data	lgth

9.2.7 SEEK

COMMAND	CLASS	INS	P1	P2	P3
SEEK	'A0'	'A2'	'00'	Type/Mode	lgth

Parameter P2 specifies type and mode:
- 'x0' = from the beginning forward;
- 'x1' = from the end backward;
- 'x2' = from the next location forward;
- 'x3' = from the previous location backward

with x='0' specifies type 1 and x='1' specifies type 2 of the SEEK command.

Command parameters/data:

Byte(s)	Description	Length
1 - lgth	Pattern	lgth

There are no response parameters/data for a type 1 SEEK. A type 2 SEEK returns the following response parameters/data:

Byte(s)	Description	Length
1	Record number	1

9.2.8 INCREASE

COMMAND	CLASS	INS	P1	P2	P3
INCREASE	'A0'	'32'	'00'	'00'	'03'

Command parameters/data:

Byte(s)	Description	Length
1 - 3	Value to be added	3

Response parameters/data:

Byte(s)	Description	Length
1 - X	Value of the increased record	X
X+1 - X+3	Value which has been added	3

NOTE: X denotes the length of the record.

9.2.9 VERIFY CHV

COMMAND	CLASS	INS	P1	P2	P3
VERIFY CHV	'A0'	'20'	'00'	CHV No.	'08'

Parameter P2 specifies the CHV:
- '01' = CHV1;
- '02' = CHV2.

Command parameters/data:

Byte(s)	Description	Length
1 - 8	CHV value	8

9.2.10 CHANGE CHV

COMMAND	CLASS	INS	P1	P2	P3
CHANGE CHV	'A0'	'24'	'00'	CHV No.	'10'

Parameter P2 specifies the CHV:
- '01' = CHV1;
- '02' = CHV2.

Command parameters/data:

Byte(s)	Description	Length
1 - 8	Old CHV value	8
9 - 16	New CHV value	8

9.2.11 DISABLE CHV

COMMAND	CLASS	INS	P1	P2	P3
DISABLE CHV	'A0'	'26'	'00'	'01'	'08'

Command parameters/data:

Byte(s)	Description	Length
1 - 8	CHV1 value	8

9.2.12 ENABLE CHV

COMMAND	CLASS	INS	P1	P2	P3
ENABLE CHV	'A0'	'28'	'00'	'01'	'08'

Command parameters/data:

Byte(s)	Description	Length
1 - 8	CHV1 value	8

9.2.13 UNBLOCK CHV

COMMAND	CLASS	INS	P1	P2	P3
UNBLOCK CHV	'A0'	'2C'	'00'	CHV No.	'10'

Parameter P2 specifies the CHV:
- 00 = CHV1;
- 02 = CHV2.

NOTE: The coding '00' for CHV1 differs from the coding of CHV1 used for other commands.

Command parameters/data:

Byte(s)	Description	Length
1 - 8	UNBLOCK CHV value	8
9 - 16	New CHV value	8

9.2.14 INVALIDATE

COMMAND	CLASS	INS	P1	P2	P3
INVALIDATE	'A0'	'04'	'00'	'00'	'00'

9.2.15 REHABILITATE

COMMAND	CLASS	INS	P1	P2	P3
REHABILITATE	'A0'	'44'	'00'	'00'	'00'

9.2.16 RUN GSM ALGORITHM

COMMAND	CLASS	INS	P1	P2	P3
RUN GSM ALGORITHM	'A0'	'88'	'00'	'00'	'10'

Command parameters/data:

Byte(s)	Description	Length
1 - 16	RAND	16

Response parameters/data:

Byte(s)	Description	Length
1 - 4	SRES	4
5 - 12	Cipher Key Kc	8

The most significant bit of SRES is coded on bit 8 of byte 1. The most significant bit of Kc is coded on bit 8 of byte 5.

9.2.17 SLEEP

COMMAND	CLASS	INS	P1	P2	P3
SLEEP	'A0'	'FA'	'00'	'00'	'00'

NOTE: This command is used by Phase 1 MEs only.

9.2.18 GET RESPONSE

COMMAND	CLASS	INS	P1	P2	P3
GET RESPONSE	'A0'	'C0'	'00'	'00'	lgth

The response data depends on the preceding command. Response data is available after the commands RUN GSM ALGORITHM, SEEK (type 2), SELECT, INCREASE and ENVELOPE. If the command GET RESPONSE is executed, it is required that it is executed immediately after the command it is related to (no other command shall come between the command/response pair and the command GET RESPONSE). If the sequence is not respected, the SIM shall send the status information "technical problem with no diagnostic given" as a reaction to the GET RESPONSE.

Since the MF is implicitly selected after activation of the SIM, GET RESPONSE is also allowed as the first command after activation.

The response data itself is defined in the subclause for the corresponding command.

9.2.19 TERMINAL PROFILE

COMMAND	CLASS	INS	P1	P2	P3
TERMINAL PROFILE	'A0'	'10'	'00'	'00'	lgth

Command parameters/data:
length `lgth`. The structure of the command parameters is defined in GSM 11.14 [27].
Response parameters/data:
none available

9.2.20 ENVELOPE

COMMAND	CLASS	INS	P1	P2	P3
ENVELOPE	'A0'	'C2'	'00'	'00'	lgth

Command parameters/data:
length `lgth`. The structure of the command parameters is defined in GSM 11.14 [27].
Response parameters/data:
The structure of the data is defined in GSM 11.14 [27].

9.2.21 FETCH

COMMAND	CLASS	INS	P1	P2	P3
FETCH	'A0'	'12'	'00'	'00'	lgth

Command parameters/data:
none.
Response parameters/data:
length `lgth`. The structure of the data is defined in GSM 11.14 [27].

9.2.22 TERMINAL RESPONSE

COMMAND	CLASS	INS	P1	P2	P3
TERMINAL RESPONSE	'A0'	'14'	'00'	'00'	lgth

Command parameters/data:
length `lgth`. The structure of the command parameters is defined in GSM 11.14 [27].
Response parameters/data:
none available.

9.3 Definitions and coding

The following definitions and coding are used in the response parameters/data of the commands.

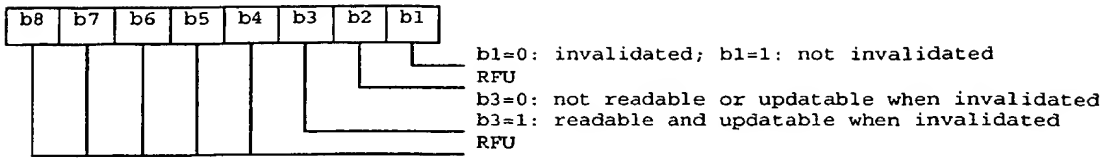
Coding

Each byte is represented by bits b8 to b1, where b8 is the most significant bit (MSB) and b1 is the least significant bit (LSB). In each representation the leftmost bit is the MSB.

RFU

In a GSM specific card all bytes which are RFU shall be set to '00' and RFU bits to 0. Where the GSM application exists on a multiapplication card or is built on a generic telecommunications card (e.g. TE9) then other values may apply. The values will be defined in the appropriate specifications for such cards. These bytes and bits shall not be interpreted by an ME in a GSM session.

File status



Bit b3 may be set to 1 in special circumstances when it is required that the EF can be read and updated even if the EF is invalidated, e.g. reading and updating the EF_{ADN} when the FDN feature is enabled, or reading and updating the EF_{BDN} when the BDN feature is disabled.

Structure of file

- '00'transparent;
- '01'linear fixed;
- '03'cyclic.

Type of File

- '00'RFU;
- '01'MF;
- '02'DF;
- '04'EF.

Coding of CHVs and UNBLOCK CHVs

A CHV is coded on 8 bytes. Only (decimal) digits (0-9) shall be used, coded in CCITT T.50 [20] with bit 8 set to zero. The minimum number of digits is 4. If the number of digits presented by the user is less than 8 then the ME shall pad the presented CHV with 'FF' before sending it to the SIM.

The coding of the UNBLOCK CHVs is identical to the coding of the CHVs. However, the number of (decimal) digits is always 8.

Coding of Access Conditions

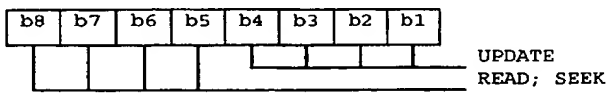
The access conditions for the commands are coded on bytes 9, 10 and 11 of the response data of the SELECT command. Each condition is coded on 4 bits as shown in table 10.

Table 10: Access conditions

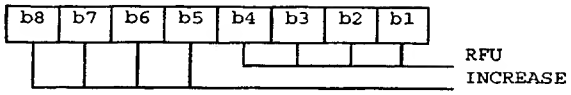
ALW	'0' *
CHV1	'1' *
CHV2	'2' *
RFU	'3'
ADM	'4'
.....	..
ADM	'E'
NEW	'F' *

Entries marked "*" in the table above, are also available for use as administrative codes in addition to the ADM access levels '4' to 'E' (refer to subclause 7.3) if required by the appropriate administrative authority. If any of these access conditions are used, the code returned in the Access Condition bytes in the response data shall be the code applicable to that particular level.

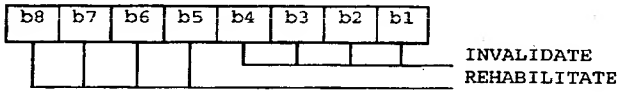
Byte 9:



Byte 10:



Byte 11:



9.4 Status conditions returned by the card

This subclause specifies the coding of the status words SW1 and SW2.

9.4.1 Responses to commands which are correctly executed

SW1	SW2	Description
'90'	'00'	- normal ending of the command
'91'	'XX'	- normal ending of the command, with extra information from the proactive SIM containing a command for the ME. Length 'XX' of the response data
'9E'	'XX'	- length 'XX' of the response data given in case of a SIM data download error
'9F'	'XX'	- length 'XX' of the response data

9.4.2 Responses to commands which are postponed

SW1	SW2	Error description
'93'	'00'	- SIM Application Toolkit is busy. Command cannot be executed at present, further normal commands are allowed.

9.4.3 Memory management

SW1	SW2	Error description
'92'	'0X'	- command successful but after using an internal update retry routine 'X' times
'92'	'40'	- memory problem

9.4.4 Referencing management

SW1	SW2	Error description
'94'	'00'	- no EF selected
'94'	'02'	- out of range (invalid address)
'94'	'04'	- file ID not found - pattern not found
'94'	'08'	- file is inconsistent with the command

9.4.5 Security management

SW1	SW2	Error description
'98'	'02'	- no CHV initialized
'98'	'04'	- access condition not fulfilled - unsuccessful CHV verification, at least one attempt left - unsuccessful UNBLOCK CHV verification, at least one attempt left - authentication failed (see note)
'98'	'08'	- in contradiction with CHV status
'98'	'10'	- in contradiction with invalidation status
'98'	'40'	- unsuccessful CHV verification, no attempt left - unsuccessful UNBLOCK CHV verification, no attempt left - CHV blocked - UNBLOCK CHV blocked
'98'	'50'	- increase cannot be performed, Max value reached

NOTE: A Phase 1 SIM may send this error code after the third consecutive unsuccessful CHV verification attempt or the tenth consecutive unsuccessful unblocking attempt.

9.4.6 Application independent errors

SW1	SW2	Error description
'67'	'XX'	- incorrect parameter P3 (see note)
'6B'	'XX'#	- incorrect parameter P1 or P2 (see ##)
'6D'	'XX'#	- unknown instruction code given in the command
'6E'	'XX'#	- wrong instruction class given in the command
'6F'	'XX'#	- technical problem with no diagnostic given

These values of 'XX' are specified by ISO/IEC; at present the default value 'XX'='00' is the only one defined.

When the error in P1 or P2 is caused by the addressed record being out of range, then the return code '94 02' shall be used.

NOTE: 'XX' gives the correct length or states that no additional information is given ('XX' = '00').

9.4.7 Commands versus possible status responses

The following table shows for each command the possible status conditions returned (marked by an asterisk *).

Table 11: Commands and status words

	OK				Busy	Mem Sta		Refer. Status				Security Status						Application Independent Errors				
	90	91	9E	9F	93	92	94	04	04	04	04	08	08	08	08	08	08	67	6B	6D	6E	6F
	00	XX	XX	XX	00	XX	00	00	02	04	08	02	04	08	10	40	50	XX	XX	XX	XX	XX
Commands																						
Select				*			*			*								*	*		*	*
Status	*	*					*											*	*		*	*
Update Binary	*	*				*	*	*			*		*		*			*	*		*	*
Update Record	*	*				*	*	*	*		*		*		*			*	*		*	*
Read Binary	*	*					*	*			*		*		*			*	*		*	*
Read Record	*	*					*	*	*		*		*		*			*	*		*	*
Seek	*			*			*	*		*	*		*		*			*	*		*	*
Increase				*		*	*	*			*		*		*		*	*	*		*	*
Verify CHV	*	*				*	*					*	*	*		*		*	*		*	*
Change CHV	*	*				*	*					*	*	*		*		*	*		*	*
Disable CHV	*	*				*	*					*	*	*		*		*	*		*	*
Enable CHV	*	*				*	*					*	*	*		*		*	*		*	*
Unblock CHV	*	*				*	*					*	*	*		*		*	*		*	*
Invalidate	*	*				*	*	*					*		*			*	*		*	*
Rehabilitate	*	*				*	*	*					*		*			*	*		*	*
Run GSM Algorithm				*			*				*		*					*	*		*	*
Sleep	*																	*	*		*	*
Get Response	*	*					*											*	*		*	*
Terminal Profile	*	*				*	*											*	*		*	*
Envelope	*	*	*	*	*	*	*											*	*		*	*
Fetch	*						*											*	*		*	*
Terminal Response	*	*				*	*											*	*		*	*

The responses '91 XX', '93 00' and '9E XX' can only be given by a SIM supporting SIM Application Toolkit, to an ME also supporting SIM Application Toolkit.

For the SEEK command the response '91 XX' can be given directly after a Type 1 SEEK command. Following the Type 2 SEEK command the SIM can give the response '91 XX' only after the GET RESPONSE command.

10 Contents of the Elementary Files (EF)

This clause specifies the EFs for the GSM session defining access conditions, data items and coding. A data item is a part of an EF which represents a complete logical entity, e.g. the alpha tag in a EF_{ADN} record.

EFs or data items having an unassigned value, or, which during the GSM session, are cleared by the ME, shall have their bytes set to 'FF'. After the administrative phase all data items shall have a defined value or have their bytes set to 'FF'. If a data item is 'deleted' during a GSM session by the allocation of a value specified in another GSM TS, then this value shall be used, and the data item is not unassigned; e.g. for a deleted LAI in EF_{LOCI} the last byte takes the value 'FE' (GSM 04.08 [15] refers).

EFs are mandatory (M) or optional (O). The file size of an optional EF may be zero. All implemented EFs with a file size greater than zero shall contain all mandatory data items. Optional data items may either be filled with 'F', or, if located at the end of an EF, need not exist.

When the coding is according to CCITT Recommendation T.50 [20], bit 8 of every byte shall be set to 0.

For an overview containing all files see figure 8.

10.1 Contents of the EFs at the MF level

There are only two EFs at the MF level.

10.1.1 EF_{ICCID} (ICC Identification)

This EF provides a unique identification number for the SIM.

Identifier: '2FE2'	Structure: transparent	Mandatory
File size: 10 bytes	Update activity: low	

Access Conditions:

READ	ALWAYS
UPDATE	NEVER
INVALIDATE	ADM
REHABILITATE	ADM

Bytes	Description	M/O	Length
1 - 10	Identification number	M	10 bytes

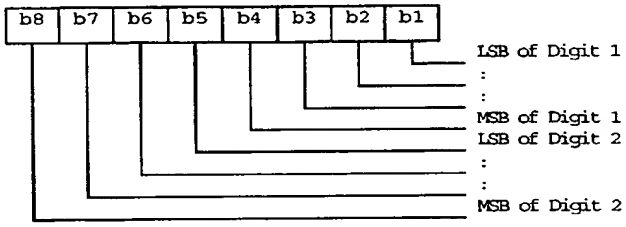
- Identification number

Contents:
according to CCITT Recommendation E.118 [18]. However, network operators who are already issuing Phase 1 SIM cards with an identification number length of 20 digits may retain this length.

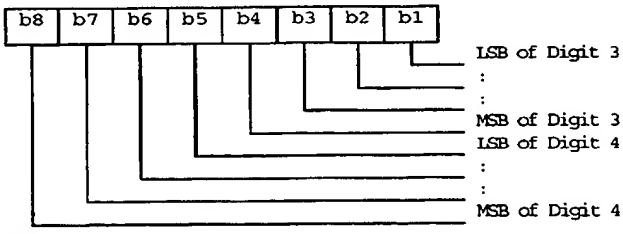
Purpose:
card identification number.

Coding:
BCD, left justified and padded with 'F'; after padding the digits within a byte are swapped (see below). However, network operators who are already issuing Phase 1 SIM cards where the digits within a byte are not swapped may retain this configuration.

Byte 1:



Byte 2:



etc.

10.1.2 EF_{ELP} (Extended language preference)

This EF contains the codes for up to n languages. This information, determined by the user/operator, defines the preferred languages of the user in order of priority. This information may be used by the ME for MMI purposes and for short message handling (e.g. screening of preferred languages in SMS-CB).

When the CB Message Identifier capability is both allocated and activated the ME selects only those CB messages the language of which corresponds to one of the languages given in this EF or in EF_{LP}, whichever of these EFs is used (see subclause 11.2.1). The CB message language is recognized according to GSM 03.38 by its data coding scheme.

Identifier: '2F 05'	Structure: transparent	Optional
File size: 2n bytes	Update activity: low	

Access Conditions:

READ	ALW
UPDATE	CHV1
INVALIDATE	ADM
REHABILITATE	ADM

Bytes	Description	M/O	Length
1 - 2	1st language code (highest prior.)	O	2 bytes
3 - 4	2nd language code	O	2 bytes
2n-1 - 2n	nth language code (lowest prior.)	O	2 bytes

Coding:

each language code is a pair of alpha-numeric characters, defined in ISO 639 [30]. Each alpha-numeric character shall be coded on one byte using the SMS default 7-bit coded alphabet as defined in GSM 03.38 [12] with bit 8 set to 0.

Unused language entries shall be set to 'FF FF'.

10.2 DFs at the GSM application level

For compatibility with other systems based on the GSM switching platform, DFs may be present as child directories of DF_{GSM}. The following have been defined.

$DF_{IRIDIUM}$	'5F30'
$DF_{GLOBALSTAR}$	'5F31'
DF_{ICO}	'5F32'
DF_{ACeS}	'5F33'
$DF_{PCS1900}$	'5F40'

10.3 Contents of files at the GSM application level

The EFs in the Dedicated File DF_{GSM} contain network related information.

10.3.1 EF_{LP} (Language preference)

This EF contains the codes for one or more languages. This information, determined by the user/operator, defines the preferred languages of the user in order of priority. This information may be used by the ME for MMI purposes and for short message handling (e.g. screening of preferred languages in SMS-CB).

When the CB Message Identifier capability is both allocated and activated the ME selects only those CB messages the language of which corresponds to one of the languages given in this EF or in EF_{ELP}, whichever of these EFs is used (see subclause 11.2.1). The CB message language is recognized according to GSM 03.41 by its data coding scheme.

Identifier: '6F05'	Structure: transparent	Mandatory
File size: 1-n bytes	Update activity: low	

Access Conditions:

READ	ALW
UPDATE	CHV1
INVALIDATE	ADM
REHABILITATE	ADM

Bytes	Description	M/O	Length
1	1st language code (highest prior.)	M	1 byte
2	2nd language code	O	1 byte
n	nth language code (lowest prior.)	O	1 byte

Coding: according to GSM 03.41 [14].

Using the command GET RESPONSE, the ME can determine the size of the EF.

10.3.2 EF_{IMSI} (IMSI)

This EF contains the International Mobile Subscriber Identity (IMSI).

Identifier: '6F07'	Structure: transparent	Mandatory
File size: 9 bytes	Update activity: low	

Access Conditions:

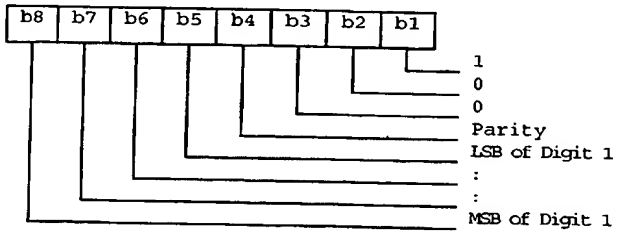
READ	CHV1
UPDATE	ADM
INVALIDATE	ADM
REHABILITATE	CHV1

Bytes	Description	M/O	Length
1	length of IMSI	M	1 byte
2 - 9	IMSI	M	8 bytes

- length of IMSI
  Contents:
  The length indicator refers to the number of significant bytes, not including this length byte, required for the IMSI.
  Coding: according to GSM 04.08 [15].

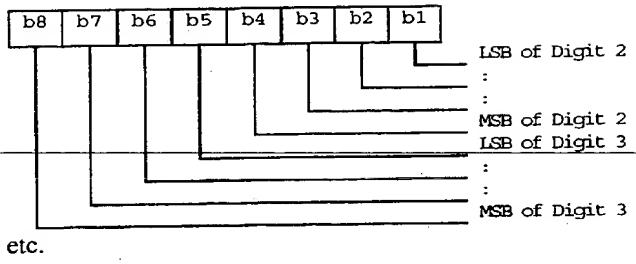
- IMSI
  Contents:
  International Mobile Subscriber Identity.
  Coding:
  This information element is of variable length. If a network operator chooses an IMSI of less than 15 digits, unused nibbles shall be set to 'F'.

  Byte 2:



For the parity bit, see GSM 04.08 [15].

Byte 3:



10.3.3 EF_{Kc} (Ciphering key Kc)

This EF contains the ciphering key Kc and the ciphering key sequence number n.

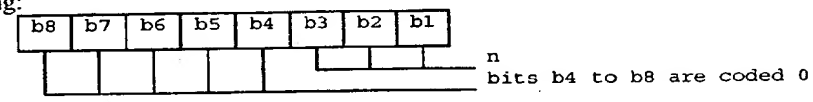
Identifier: '6F20'	Structure: transparent	Mandatory
File size: 9 bytes	Update activity: high	

Access Conditions:

READ	CHV1
UPDATE	CHV1
INVALIDATE	ADM
REHABILITATE	ADM

Bytes	Description	M/O	Length
1 - 8	Ciphering key Kc	M	8 bytes
9	Ciphering key sequence number n	M	1 byte

- Ciphering key Kc
  Coding:
  The least significant bit of Kc is the least significant bit of the eighth byte. The most significant bit of Kc is the most significant bit of the first byte.
- Ciphering key sequence number n
  Coding:



NOTE: GSM 04.08 [15] defines the value of n=111 as "key not available". Therefore the value '07' and not 'FF' should be present following the administrative phase.

10.3.4 $EF_{PLMNsel}$ (PLMN selector)

This EF contains the coding for n PLMNs, where n is at least eight. This information determined by the user/operator defines the preferred PLMNs of the user in priority order.

Identifier: '6F30'	Structure: transparent	Optional
File size: 3n (n ≥ 8) bytes	Update activity: low	

Access Conditions:

READ	CHV1
UPDATE	CHV1
INVALIDATE	ADM
REHABILITATE	ADM

Bytes	Description	M/O	Length
1 - 3	1st PLMN (highest priority)	M	3 bytes
22 - 24	8th PLMN	M	3 bytes
25 - 27	9th PLMN	O	3 bytes
(3n-2)-3n	nth PLMN (lowest priority)	O	3 bytes

- PLMN

  Contents:

  Mobile Country Code (MCC) followed by the Mobile Network Code (MNC).

  Coding:

  according to GSM 04.08 [15].

  If storage for fewer than the maximum possible number n is required, the excess bytes shall be set to 'FF'.

  For instance, using 246 for the MCC and 81 for the MNC and if this is the first and only PLMN, the contents reads as follows:

  Bytes 1-3: '42' 'F6' '18'

  Bytes 4-6: 'FF' 'FF' 'FF'

  etc.

10.3.5 EF_{HPLMN} (HPLMN search period)

This EF contains the interval of time between searches for the HPLMN (see GSM 02.11 [5]).

Identifier: '6F31'	Structure: transparent	Mandatory
File size: 1 byte	Update activity: low	

Access Conditions:

READ	CHV1
UPDATE	ADM
INVALIDATE	ADM
REHABILITATE	ADM

Bytes	Description	M/O	Length
1	Time interval	M	1 byte

- Time interval

  Contents:

  The time interval between two searches.

  Coding:

  The time interval is coded in integer multiples of n minutes. The range is from n minutes to a maximum value. The value '00' indicates that no attempts shall be made to search for the HPLMN. The encoding is:

  - '00': No HPLMN search attempts
  - '01': n minutes
  - '02': 2n minutes
  - : :
  - 'YZ': (16Y+Z)n minutes (maximum value)

  All other values shall be interpreted by the ME as a default period.

For specification of the integer timer interval n, the maximum value and the default period refer to GSM 02.11 [5].

10.3.6 EF_{ACMmax} (ACM maximum value)

This EF contains the maximum value of the accumulated call meter. This EF shall always be allocated if EF_{ACM} is allocated.

Identifier: '6F37'	Structure: transparent	Optional
File size: 3 bytes	Update activity: low	

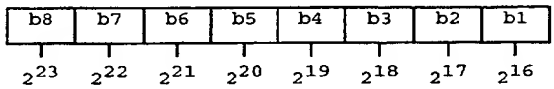
Access Conditions:

READ	CHV1
UPDATE	CHV1/CHV2 (fixed during administrative management)
INVALIDATE	ADM
REHABILITATE	ADM

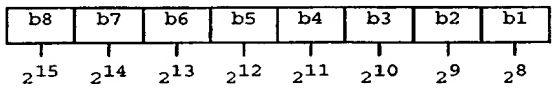
Bytes	Description	M/O	Length
1 - 3	Maximum value	M	3 bytes

- Maximum value
  Contents:
  maximum value of the Accumulated Call Meter (ACM)
  Coding:

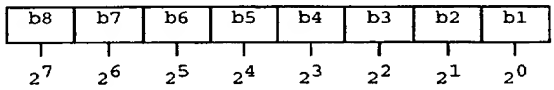
  First byte:



  Second byte:



  Third byte:



  For instance, '00' '00' '30' represents 2^5+2^4.

All ACM data is stored in the SIM and transmitted over the SIM/ME interface as binary.

ACMmax is not valid, as defined in GSM 02.24 [7], if it is coded '000000'.

10.3.7 EF_{SST} (SIM service table)

This EF indicates which services are allocated, and whether, if allocated, the service is activated. If a service is not allocated or not activated in the SIM, the ME shall not select this service.

Identifier: '6F38'	Structure: transparent	Mandatory
File size: X bytes, X ≥ 2	Update activity: low	

Access Conditions:

READ	CHV1
UPDATE	ADM
INVALIDATE	ADM
REHABILITATE	ADM

Bytes	Description	M/O	Length
1	Services n°1 to n°4	M	1 byte
2	Services n°5 to n°8	M	1 byte
3	Services n°9 to n°12	O	1 byte
4	Services n°13 to n°16	O	1 byte
5	Services n°17 to n°20	O	1 byte
6	Services n°21 to n°24	O	1 byte
7	Services n°25 to n°28	O	1 byte
8	Services n°29 to n°32	O	1 byte
etc.			
X	Services (4X-3) to (4X)	O	1 byte

-Services

Contents:

Service n°1 : CHV1 disable function
Service n°2 : Abbreviated Dialling Numbers (ADN)
Service n°3 : Fixed Dialling Numbers (FDN)
Service n°4 : Short Message Storage (SMS)
Service n°5 : Advice of Charge (AoC)
Service n°6 : Capability Configuration Parameters (CCP)
Service n°7 : PLMN selector
Service n°8 : RFU
Service n°9 : MSISDN
Service n°10: Extension1
Service n°11: Extension2
Service n°12: SMS Parameters
Service n°13: Last Number Dialled (LND)
Service n°14: Cell Broadcast Message Identifier
Service n°15: Group Identifier Level 1
Service n°16: Group Identifier Level 2
Service n°17: Service Provider Name
Service n°18: Service Dialling Numbers (SDN)
Service n°19: Extension3
Service n°20: RFU
Service n°21: VGCS Group Identifier List (EF_{VGCS} and EF_{VGCSS})
Service n°22: VBS Group Identifier List (EF_{VBS} and EF_{VBSS})
Service n°23: enhanced Multi-Level Precedence and Pre-emption Service
Service n°24: Automatic Answer for eMLPP
Service n°25: Data download via SMS-CB
Service n°26: Data download via SMS-PP
Service n°27: Menu selection
Service n°28: Call control
Service n°29: Proactive SIM
Service n°30: Cell Broadcast Message Identifier Ranges
Service n°31: Barred Dialling Numbers (BDN)
Service n°32: Extension4
Service n°33: De-personalization Control Keys
Service n°34: Co-operative Network List
Service n°35: Short Message Status Reports
Service n°36 Network's indication of alerting in the MS
Service n°37 Mobile Originated Short Message control by SIM
Service n°38 GPRS

For a phase 2 SIM, the EF shall contain at least two bytes which correspond to the Phase 1 services. Further bytes may be included, but if the EF includes an optional byte, then it is mandatory for the EF to also contain all bytes before that byte. Other services are possible in the future and will be coded on further bytes in the EF. The coding falls under the responsibility of ETSI.

NOTE 1: Service N°8 was used in Phase 1 for Called Party Subaddress. To prevent any risk of incompatibility Service N°8 should not be reallocated.

NOTE 2: As the BDN service relies on the Call Control feature, service n°31 (BDN) should only be allocated and activated if service n°28 (Call control) is allocated and activated.

Coding:

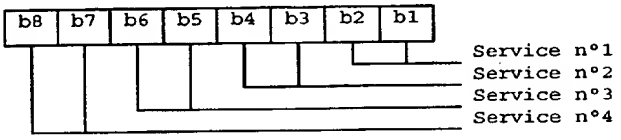
2 bits are used to code each service:
first bit = 1: service allocated
first bit = 0: service not allocated
where the first bit is b1, b3, b5 or b7;
second bit = 1: service activated
second bit = 0: service not activated
where the second bit is b2, b4, b6 or b8.

Service allocated means that the SIM has the capability to support the service. Service activated means that the service is available for the card holder (only valid if the service is allocated).

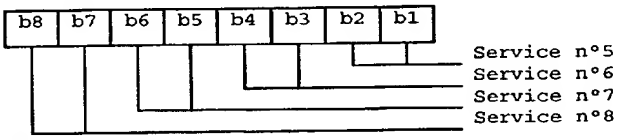
The following codings are possible:
- first bit = 0: service not allocated, second bit has no meaning;
- first bit = 1 and second bit = 0: service allocated but not activated;
- first bit = 1 and second bit = 1: service allocated and activated.

The bits for services not yet defined shall be set to RFU. For coding of RFU see subclause 9.3.

First byte:

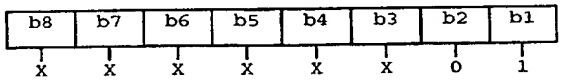


Second byte:



etc.

The following example of coding for the first byte means that service n°1 "CHV1-Disabling" is allocated but not activated:



If the SIM supports the FDN feature (FDN allocated and activated) a special mechanism shall exist in the SIM which invalidates both EF_{IMSI} and EF_{LOCI} once during each GSM session. This mechanism shall be invoked by the SIM automatically if FDN is enabled. This invalidation shall occur at least before the next command following selection of either EF. FDN is enabled when the ADN is invalidated or not activated.

If the SIM supports the BDN feature (BDN allocated and activated) a special mechanism shall exist in the SIM which invalidates both EF_{IMSI} and EF_{LOCI} once during each GSM session and which forbids the REHABILITATE command to rehabilitate both EF_{IMSI} and EF_{LOCI} until the PROFILE DOWNLOAD procedure is performed indicating that the ME supports the "Call control by SIM" facility. This mechanism shall be invoked by the SIM automatically if BDN is enabled. The invalidation of EF_{IMSI} and EF_{LOCI} shall occur at least before the next command following selection of either EF. BDN is enabled when the EF_{BDN} is not invalidated.

10.3.8 EF_{ACM} (Accumulated call meter)

This EF contains the total number of units for both the current call and the preceding calls.

NOTE: The information may be used to provide an indication to the user for advice or as a basis for the calculation of the monetary cost of calls (see GSM 02.86 [9]).

Identifier: '6F39'	Structure: cyclic	Optional
Record length: 3 bytes	Update activity: high	

Access Conditions:

READ	CHV1
UPDATE	CHV1/CHV2 (fixed during administrative management)
INCREASE	CHV1
INVALIDATE	ADM
REHABILITATE	ADM

Bytes	Description	M/O	Length
1 - 3	Accumulated count of units	M	3 bytes

- Accumulated count of units
  Contents: value of the ACM
  Coding: see the coding of EF_{ACMmax}

10.3.9 EF_{GID1} (Group Identifier Level 1)

This EF contains identifiers for particular SIM-ME associations. It can be used to identify a group of SIMs for a particular application.

Identifier: '6F3E'	Structure: transparent	Optional
File size: 1-n bytes	Update activity: low	

Access Conditions:

READ	CHV1
UPDATE	ADM
INVALIDATE	ADM
REHABILITATE	ADM

Bytes	Description	M/O	Length
1 - n	SIM group identifier(s)	O	n bytes

10.3.10 EF_{GID2} (Group Identifier Level 2)

This EF contains identifiers for particular SIM-ME associations. It can be used to identify a group of SIMs for a particular application.

Identifier: '6F3F'	Structure: transparent	Optional
File size: 1-n bytes	Update activity: low	

Access Conditions:

READ	CHV1
UPDATE	ADM
INVALIDATE	ADM
REHABILITATE	ADM

Bytes	Description	M/O	Length
1 - n	SIM group identifier(s)	O	n bytes

NOTE: The structure of EF_{GID1} and EF_{GID2} are identical. They are provided to allow the network operator to enforce different levels of security dependant on application.

10.3.11 EF_{SPN} (Service Provider Name)

This EF contains the service provider name and appropriate requirements for the display by the ME.

Identifier: '6F46'	Structure: transparent	Optional
File Size: 17 bytes	Update activity: low	

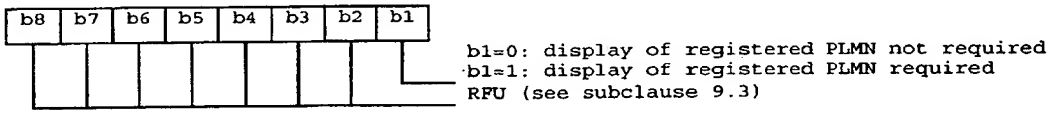
Access Conditions:

READ	ALWAYS
UPDATE	ADM
INVALIDATE	ADM
REHABILITATE	ADM

Bytes	Description	M/O	Length
1	Display Condition	M	1 byte
2 - 17	Service Provider Name	M	16 bytes

- Display Condition
  Contents: display condition for the service provider name in respect to the registered PLMN (see GSM 02.07 [3]).

  Coding: see below
  Byte 1:



- Service Provider Name
  Contents: service provider string to be displayed
  Coding: the string shall use either
  - the SMS default 7-bit coded alphabet as defined in GSM 03.38 [12] with bit 8 set to 0. The string shall be left justified. Unused bytes shall be set to 'FF'.
  - one of the UCS2 code options defined in Annex B.

10.3.12 EF_{PUCT} (Price per unit and currency table)

This EF contains the Price per Unit and Currency Table (PUCT). The PUCT is Advice of Charge related information which may be used by the ME in conjunction with EF_{ACM} to compute the cost of calls in the currency chosen by the subscriber, as specified in GSM 02.24 [7]. This EF shall always be allocated if EF_{ACM} is allocated.

Identifier: '6F41'	Structure: transparent	Optional
File size: 5 bytes	Update activity: low	

Access Conditions:

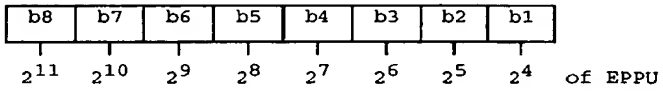
READ	CHV1
UPDATE	CHV1/CHV2 (fixed during administrative management)
INVALIDATE	ADM
REHABILITATE	ADM

Bytes	Description	M/O	Length
1 - 3	Currency code	M	3 bytes
4 - 5	Price per unit	M	2 bytes

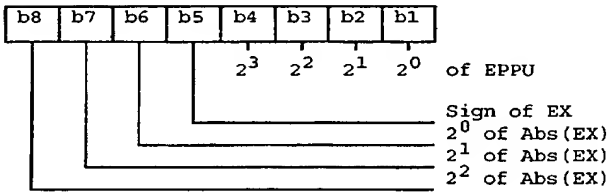
- Currency code
  Contents:
  the alpha-identifier of the currency code.
  Coding:
  bytes 1, 2 and 3 are the respective first, second and third character of the alpha identifier. This alpha-tagging shall use the SMS default 7-bit coded alphabet as defined in GSM 03.38 [12] with bit 8 set to 0.

- Price per unit
  Contents:
  price per unit expressed in the currency coded by bytes 1-3.
  Coding:
  Byte 4 and bits b1 to b4 of byte 5 represent the Elementary Price per Unit (EPPU) in the currency coded by bytes 1-3. Bits b5 to b8 of byte 5 are the decimal logarithm of the multiplicative factor represented by the absolute value of its decimal logarithm (EX) and the sign of EX, which is coded 0 for a positive sign and 1 for a negative sign.

  Byte 4:



  Byte 5:



  The computation of the price per unit value is made by the ME in compliance with GSM 02.24 [7] by the following formula:

  price per unit = EPPU * 10^{EX}.

  The price has to be understood as expressed in the coded currency.

10.3.13 EF_{CBMI} (Cell broadcast message identifier selection)

This EF contains the Message Identifier Parameters which specify the type of content of the cell broadcast messages that the subscriber wishes the MS to accept.

Any number of CB Message Identifier Parameters may be stored in the SIM. No order of priority is applicable.

Identifier: '6F45'	Structure: transparent	Optional
File size: 2n bytes	Update activity: low	

Access Conditions:

READ	CHV1
UPDATE	CHV1
INVALIDATE	ADM
REHABILITATE	ADM

Bytes	Description	M/O	Length
1 - 2	CB Message Identifier 1	O	2 bytes
3 - 4	CB Message Identifier 2	O	2 bytes
2n-1 - 2n	CB Message Identifier n	O	2 bytes

- Cell Broadcast Message Identifier
  Coding:
  as in GSM 03.41, "Message Format on BTS-MS Interface - Message Identifier".
  Values listed show the types of message which shall be accepted by the MS.
  Unused entries shall be set to 'FF FF'.

10.3.14 EF_{BCCH} (Broadcast control channels)

This EF contains information concerning the BCCH according to GSM 04.08 [15].

BCCH storage may reduce the extent of a Mobile Station's search of BCCH carriers when selecting a cell. The BCCH carrier lists in an MS shall be in accordance with the procedures specified in GSM 04.08 [15]. The MS shall only store BCCH information from the System Information 2 message and not the 2bis extension message.

Identifier: '6F74'	Structure: transparent	Mandatory
File size: 16 bytes	Update activity: high	

Access Conditions:

READ	CHV1
UPDATE	CHV1
INVALIDATE	ADM
REHABILITATE	ADM

Bytes	Description	M/O	Length
1 - 16	BCCH information	M	16 bytes

- BCCH information
  Coding:
  The information is coded as octets 2-17 of the "neighbour cells description information element" in GSM 04.08 [15].

10.3.15 EF_{ACC} (Access control class)

This EF contains the assigned access control class(es). GSM 02.11 [5] refers. The access control class is a parameter to control the RACH utilization. 15 classes are split into 10 classes randomly allocated to normal subscribers and 5 classes allocated to specific high priority users. For more information see GSM 02.11 [5].

Identifier: '6F78'	Structure: transparent	Mandatory
File size: 2 bytes	Update activity: low	

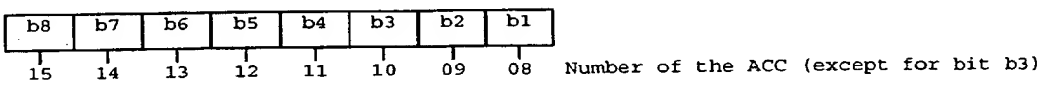
Access Conditions:

READ	CHV1
UPDATE	ADM
INVALIDATE	ADM
REHABILITATE	ADM

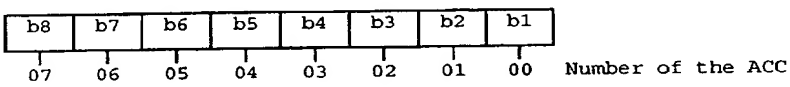
Bytes	Description	M/O	Length
1 - 2	Access control classes	M	2 bytes

- Access control classes
  Coding:
  Each ACC is coded on one bit. An ACC is "allocated" if the corresponding bit is set to 1 and "not allocated" if this bit is set to 0. Bit b3 of byte 1 is set to 0.

Byte 1:



Byte 2:



10.3.16 EF_{FPLMN} (Forbidden PLMNs)

This EF contains the coding for four Forbidden PLMNs (FPLMN). It is read by the ME as part of the SIM initialization procedure and indicates PLMNs which the MS shall not automatically attempt to access.

A PLMN is written to the EF if a network rejects a Location Update with the cause "PLMN not allowed". The ME shall manage the list as follows.

When four FPLMNs are held in the EF, and rejection of a further PLMN is received by the ME from the network, the ME shall modify the EF using the UPDATE command. This new PLMN shall be stored in the fourth position, and the existing list "shifted" causing the previous contents of the first position to be lost.

When less than four FPLMNs exist in the EF, storage of an additional FPLMN shall not cause any existing FPLMN to be lost.

Dependent upon procedures used to manage storage and deletion of FPLMNs in the EF, it is possible, when less than four FPLMNs exist in the EF, for 'FFFFFF' to occur in any position. The ME shall analyse all the EF for FPLMNs in any position, and not regard 'FFFFFF' as a termination of valid data.

Identifier: '6F7B'	Structure: transparent	Mandatory
File size: 12 bytes	Update activity: low	

Access Conditions:

READ	CHV1
UPDATE	CHV1
INVALIDATE	ADM
REHABILITATE	ADM

Bytes	Description	M/O	Length
1 - 3	PLMN 1	M	3 bytes
4 - 6	PLMN 2	M	3 bytes
7 - 9	PLMN 3	M	3 bytes
10 - 12	PLMN 4	M	3 bytes

- PLMN

  Contents:

  Mobile Country Code (MCC) followed by the Mobile Network Code (MNC).

  Coding:

  according to GSM 04.08 [15].

  For instance, using 246 for the MCC and 81 for the MNC and if this is stored in PLMN 3 the contents is as follows:

  Bytes 7-9: '42' 'F6' '18'

  If storage for fewer than 4 PLMNs is required, the unused bytes shall be set to 'FF'.

10.3.17 EF_{LOCI} (Location information)

This EF contains the following Location Information:

- Temporary Mobile Subscriber Identity (TMSI)
- Location Area Information (LAI)
- TMSI TIME
- Location update status

Identifier: '6F7E'	Structure: transparent	Mandatory
File size: 11 bytes	Update activity: high	

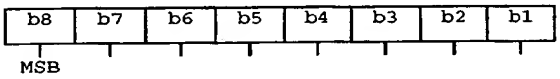
Access Conditions:

READ	CHV1
UPDATE	CHV1
INVALIDATE	ADM
REHABILITATE	CHV1

Bytes	Description	M/O	Length
1 - 4	TMSI	M	4 bytes
5 - 9	LAI	M	5 bytes
10	TMSI TIME	M	1 byte
11	Location update status	M	1 byte

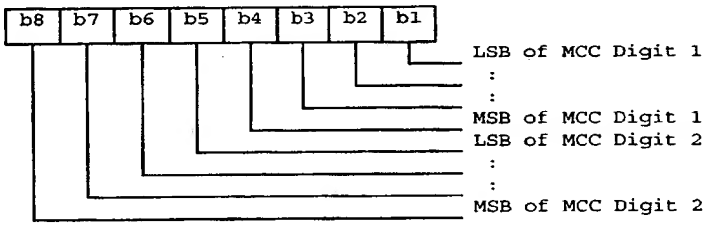
- TMSI
  Contents: Temporary Mobile Subscriber Identity
  Coding: according to GSM 04.08 [15].

Byte 1: first byte of TMSI

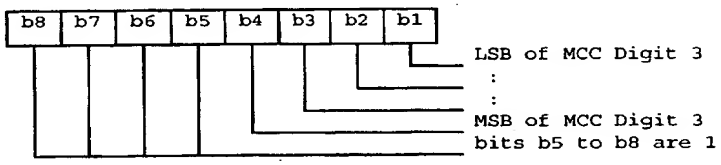


- LAI
  Contents: Location Area Information
  Coding: according to GSM 04.08 [15].

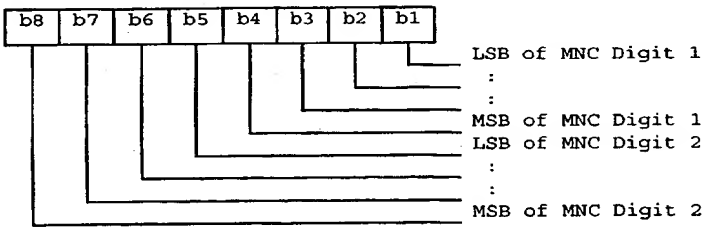
Byte 5: first byte of LAI (MCC)



Byte 6: second byte of LAI (MCC continued)



Byte 7: third byte of LAI (MNC)



Byte 8: fourth byte of LAI (LAC)

Byte 9: fifth byte of LAI (LAC continued)

- TMSI TIME

Contents: Current value of Periodic Location Updating Timer (T3212).
This byte is used by Phase 1 MEs, but it shall not be used by Phase 2 MEs.

- Location update status
Contents: status of location update according to GSM 04.08 [15].
Coding:
Byte 11:

Bits:	b3	b2	b1	
0	0	0	:	updated
0	0	1	:	not updated
0	1	0	:	PLMN not allowed
0	1	1	:	Location Area not allowed
1	1	1	:	reserved

Bits b4 to b8 are RFU (see subclause 9.3).

10.3.18 EF_{AD} (Administrative data)

This EF contains information concerning the mode of operation according to the type of SIM, such as normal (to be used by PLMN subscribers for GSM operations), type approval (to allow specific use of the ME during type approval procedures of e.g. the radio equipment), cell testing (to allow testing of a cell before commercial use of this cell), manufacturer specific (to allow the ME manufacturer to perform specific proprietary auto-test in its ME during e.g. maintenance phases).

It also provides an indication of whether some ME features should be activated during normal operation.

Identifier: '6FAD'	Structure: transparent	Mandatory
File size: 3+X bytes	Update activity: low	

Access Conditions:

READ	ALW
UPDATE	ADM
INVALIDATE	ADM
REHABILITATE	ADM

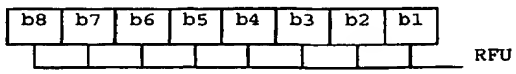
Bytes	Description	M/O	Length
1	MS operation mode	M	1 byte
2 - 3	Additional information	M	2 bytes
4 - 3+X	RFU	O	X bytes

- MS operation mode
Contents: mode of operation for the MS
Coding:
Initial value

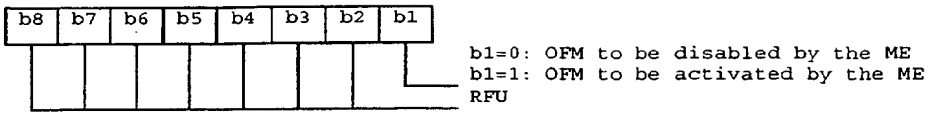
- normal operation	'00'
- type approval operations	'80'
- normal operation + specific facilities	'01'
- type approval operations + specific facilities	'81'
- maintenance (off line)	'02'
- cell test operation	'04'

- Additional information
Coding:
- specific facilities (if b1=1 in byte 1);

Byte 2 (first byte of additional information):



Byte 3:



- ME manufacturer specific information (if b2=1 in byte 1).

10.3.19 EF_{Phase} (Phase identification)

This EF contains information concerning the phase of the SIM.

Identifier: '6FAE'	Structure: transparent	Mandatory
File size: 1 byte	Update activity: low	

Access Conditions:

READ	ALW
UPDATE	ADM
INVALIDATE	ADM
REHABILITATE	ADM

Bytes	Description	M/O	Length
1	SIM Phase	M	1 byte

- SIM Phase
  Coding:
  '00' : phase 1
  '02' : phase 2
  '03' : phase 2 and PROFILE DOWNLOAD required (see GSM 11.14 [27]).

  All other codings are reserved for specification by ETSI TC SMG. Codings '04' to '0F' indicate that the SIM supports, as a minimum, the mandatory requirements defined in this specification.

This phase identification does not preclude a SIM to support some features of a phase later than the one indicated in EF_{Phase}. For example : if EF_{Phase} is coded '00', it may be assumed by the ME that some Phase 2 or Phase 2+ features are supported by this SIM; if EF_{Phase} is coded '02' or '03', it may be assumed by the ME that some Phase 2+ features are supported by this SIM.

However, the services n°3 (FDN) and/or n°5 (AoC) shall only be allocated and activated in SIMs of phase 2 or later with EF_{Phase} being coded '02' or greater. Similarly, service n°31 (BDN) shall only be allocated and activated in SIMs with EF_{Phase} being coded '03' or greater.

If EF_{Phase} is coded '03' or greater, an ME supporting SIM Application Toolkit shall perform the PROFILE DOWNLOAD procedure, as defined in GSM 11.14 [27].

10.3.20 EF_{VGCS} (Voice Group Call Service)

This EF contains a list of those VGCS group identifiers the user has subscribed to. The elementary file is used by the ME for group call establishment and group call reception.

Identifier: '6FB1'	Structure: transparent	Optional
File size: 4n bytes (n <= 50)	Update activity: low	

Access Conditions:

READ	CHV1
UPDATE	ADM
INVALIDATE	ADM
REHABILITATE	ADM

Bytes	Description	M/O	Length
1 - 4	Group ID 1	M	4 bytes
5 - 8	Group ID 2	O	4 bytes
:	:	:	:
(4n-3)-4n	Group ID n	O	4 bytes

- Group ID

Contents: VGCS Group Id
Coding: according to GSM 03.03 [10]
If storage for fewer than the maximum possible number of n is required, the excess bytes shall be set to 'FF'.

10.3.21 EF_{VGCSS} (Voice Group Call Service Status)

This EF contains the status of activation for the VGCS group identifiers. The elementary file is directly related to the EF_{VGCS}. This EF shall always be allocated if EF_{VGCS} is allocated.

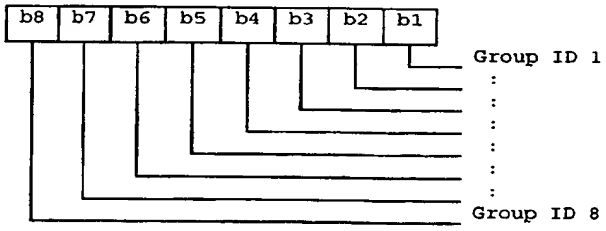
Identifier: '6FB2'	Structure: transparent	Optional
File size: 7 bytes	Update activity: low	

Access Conditions:

READ	CHV1
UPDATE	ADM
INVALIDATE	ADM
REHABILITATE	ADM

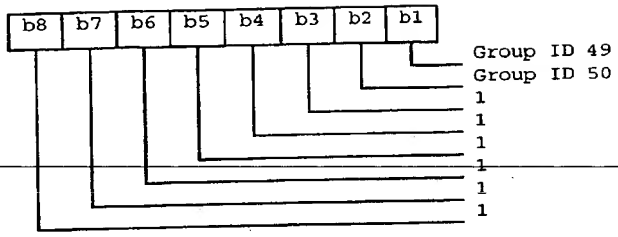
Bytes	Description	M/O	Length
1 - 7	Activation/Deactivation Flags	M	7 bytes

- Activation/Deactivation Flags
Contents: Activation/Deactivation Flags of the appropriate Group IDs
Coding:
bit = 0 means - Group ID deactivated
bit = 1 means - Group ID activated
Byte 1:



etc : : : : : : : :

Byte 7:



10.3.22 EF_{VBS} (Voice Broadcast Service)

This EF contains a list of those VBS group identifiers the user has subscribed to. The elementary file is used by the ME for broadcast call establishment and broadcast call reception.

Identifier: '6FB3'	Structure: transparent	Optional
File size: 4n bytes (n <= 50)	Update activity: low	

Access Conditions:

READ	CHV1
UPDATE	ADM
INVALIDATE	ADM
REHABILITATE	ADM

Bytes	Description	M/O	Length
1 - 4	Group ID 1	M	4 bytes
5 - 2	Group ID 2	O	4 bytes
:	:	:	:
(4n-3)-4n	Group ID n	O	4 bytes

- Group ID
  Contents: VBS Group Id
  Coding: according to GSM 03.03 [10]
  If storage for fewer than the maximum possible number of n is required, the excess bytes shall be set to 'FF'.

10.3.23 EF_{VBSS} (Voice Broadcast Service Status)

This EF contains the status of activation for the VBS group identifiers. The elementary file is directly related to the EF_{VBS}. This EF shall always be allocated if EF_{VBS} is allocated.

Identifier: '6FB4'	Structure: transparent	Optional
File size: 7 bytes	Update activity: low	

Access Conditions:

READ	CHV1
UPDATE	ADM
INVALIDATE	ADM
REHABILITATE	ADM

Bytes	Description	M/O	Length
1 - 7	Activation/Deactivation Flags	M	7 bytes

- Activation/Deactivation Flags
  Contents: Activation/Deactivation Flags of the appropriate Group IDs
  Coding:
  see coding of EF_{VGCS}

10.3.24 EF_{eMLPP} (enhanced Multi Level Pre-emption and Priority)

This EF contains information about priority levels and fast call set-up conditions for the enhanced Multi Level Pre-emption and Priority service that which can be used by the subscriber.

Identifier: '6FB5'	Structure: transparent	Optional
File size: 2 bytes	Update activity: low	

Access Conditions:

READ	CHV1
UPDATE	ADM
INVALIDATE	ADM
REHABILITATE	ADM

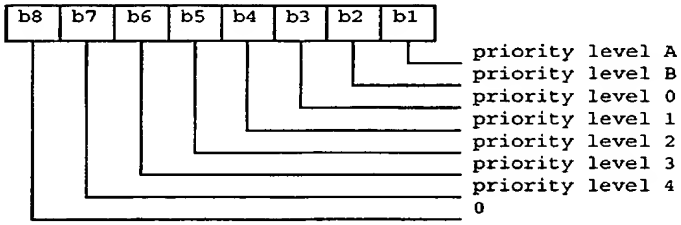
Bytes	Description	M/O	Length
1	Priority levels	M	1 byte
2	Fast call set-up conditions	M	1 byte

- Priority levels

  Contents: The eMLPP priority levels subscribed to.

  Coding: Each eMLPP priority level is coded on one bit. Priority levels subscribed to have their corresponding bits set to 1. Priority levels not subscribed to have their corresponding bits set to 0. Bit b8 is reserved and set to 0.

  Byte 1:



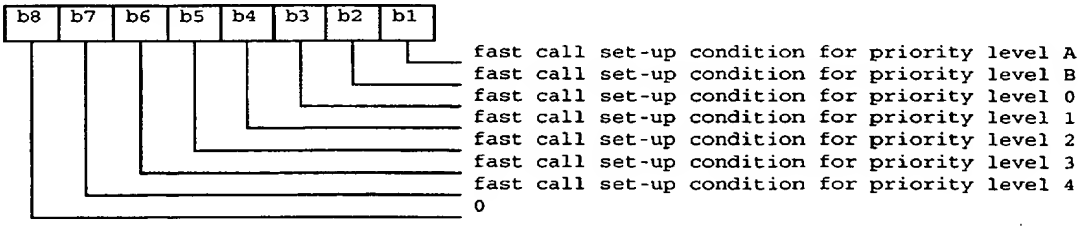
  Example: If priority levels B and 2 are subscribed to, EF_{eMLPP} shall be coded '12'.

- Fast call set-up conditions

  Contents: For each eMLPP priority level, the capability to use a fast call set-up procedure.

  Coding: Each eMLPP priority level is coded on one bit. Priority levels for which fast call set-up is allowed have their corresponding bits set to 1. Priority levels for which fast call set-up is not allowed have their corresponding bits set to 0. Bit b8 is reserved and set to 0.

  Byte 2:



  Example: If fast call set-up is allowed for priority levels B, 0 and 2, then byte 2 of EF_{eMLPP} is coded '16'.

10.3.25 EF_{AAeM} (Automatic Answer for eMLPP Service)

This EF contains those priority levels (of the Multi Level Pre-emption and Priority service) for which the mobile station shall answer automatically to incoming calls.

Identifier: '6FB6'	Structure: transparent	Optional
File size: 1 byte	Update activity: low	

Access Conditions:

READ	CHV1
UPDATE	CHV1
INVALIDATE	ADM
REHABILITATE	ADM

Bytes	Description	M/O	Length
1	Automatic answer priority levels	M	1 byte

- Automatic answer priority levels

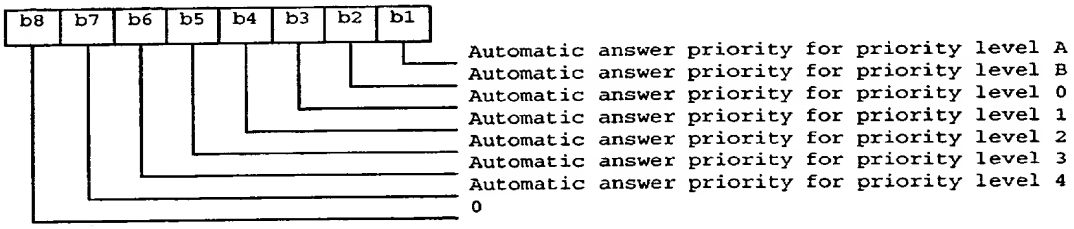
Contents:

For each eMLPP priority level, the capability for the mobile station to answer automatically to incoming calls (with the corresponding eMLPP priority level).

Coding:

Each eMLPP priority level is coded on one bit. Priority levels allowing an automatic answer from the mobile station have their corresponding bits set to 1. Priority levels not allowing an automatic answer from the mobile station have their corresponding bits set to 0. Bit b8 is reserved and set to 0.

Byte 1:



Example: If automatic answer is allowed for incoming calls with priority levels A, 0 and 1, then $EF_{AAeMLPP}$ is coded '0D'.

10.3.26 EF_{CBMID} (Cell Broadcast Message Identifier for Data Download)

This EF contains the message identifier parameters which specify the type of content of the cell broadcast messages which are to be passed to the SIM.

Any number of CB message identifier parameters may be stored in the SIM. No order of priority is applicable.

Identifier: '6F48'	Structure: transparent	Optional
File size: 2n bytes	Update activity: low	

Access Conditions:

READ	CHV1
UPDATE	ADM
INVALIDATE	ADM
REHABILITATE	ADM

Bytes	Description	M/O	Length
1-2	CB Message Identifier 1	O	2 bytes
3-4	CB Message Identifier 2	O	2 bytes
2n-1-2n	CB Message Identifier n	O	2 bytes

- Cell Broadcast Message Identifier

Coding:

as in GSM 03.41 [14]. Values listed show the identifiers of messages which shall be accepted by the MS to be passed to the SIM.

Unused entries shall be set to 'FF FF'.

10.3.27 EF_{Ecc} (Emergency Call Codes)

This EF contains up to 5 emergency call codes.

Identifier: '6FB7'	Structure: transparent	Optional
File size: 3n (n ≤ 5) bytes	Update activity: low	

Access Conditions:

READ	ALW
UPDATE	ADM
INVALIDATE	ADM
REHABILITATE	ADM

Bytes	Description	M/O	Length
1 - 3	Emergency Call Code 1	O	3 bytes
4 - 6	Emergency Call Code 2	O	3 bytes
(3n-2) - 3n	Emergency Call Code n	O	3 bytes

- Emergency Call Code

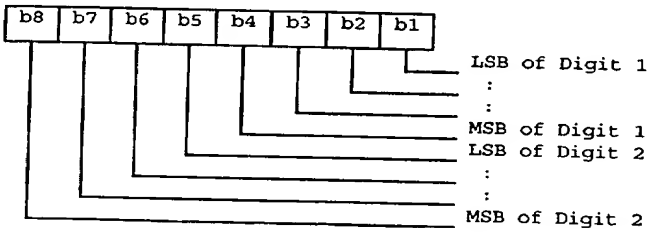
Contents:

Emergency Call Code

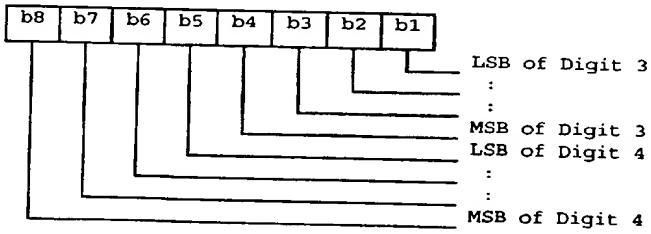
Coding:

The emergency call code is of a variable length with a maximum length of 6 digits. Each emergency call code is coded on three bytes, with each digit within the code being coded on four bits as shown below. If a code of less that 6 digits is chosen, then the unused nibbles shall be set to 'F'.

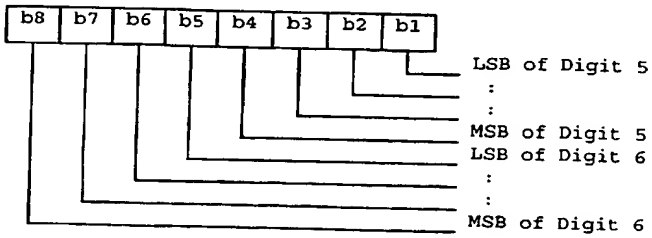
Byte 1:



Byte 2:



Byte 3:



10.3.28 EF_{CBMIR} (Cell broadcast message identifier range selection)

This EF contains ranges of cell broadcast message identifiers that the subscriber wishes the MS to accept.

Any number of CB Message Identifier Parameter ranges may be stored in the SIM. No order of priority is applicable.

Identifier: '6F50'	Structure: transparent	Optional
File size: 4n bytes	Update activity: low	

Access Conditions:

READ	CHV1
UPDATE	CHV1
INVALIDATE	ADM
REHABILITATE	ADM

Bytes	Description	M/O	Length
1 - 4	CB Message Identifier Range 1	O	4 bytes
5 - 8	CB Message Identifier Range 2	O	4 bytes
(4n-3) - 4n	CB Message Identifier Range n	O	4 bytes

- Cell Broadcast Message Identifier Ranges

  Contents:

  CB Message Identifier ranges:

  Coding:

  bytes one and two of each range identifier equal the lower value of a cell broadcast range, bytes three and four equal the upper value of a cell broadcast range, both values are coded as in GSM 03.41 [14] "Message Format on BTS-MS Interface - Message Identifier". Values listed show the ranges of messages which shall be accepted by the MS.

  Unused entries shall be set to 'FF FF FF FF'.

10.3.29 EF_{DCK} De-personalization Control Keys

This EF provides storage for the de-personalization control keys associated with the OTA de-personalization cycle of GSM 02.22.

Identifier: '6F2C'	Structure: transparent	Optional
File size: 16 bytes	Update activity: low	

Access Conditions:

READ	CHV1
UPDATE	CHV1
INVALIDATE	ADM
REHABILITATE	ADM

Bytes	Description	M/O	Length
1 to 4	8 digits of network de-personalization control key	M	4 bytes
5 to 8	8 digits of network subset de-personalization control key	M	4 bytes
9 to 12	8 digits of service provider de-personalization control key	M	4 bytes
13 to 16	8 digits of corporate de-personalization control key	M	4 bytes

Empty control key records shall be coded 'FFFFFFFF'.

10.3.30 EF_{CNL}(Co-operative Network List)

This EF contains the Co-operative Network List for the multiple network personalization services defined in GSM 02.22.

Identifier: '6F32'	Structure: transparent	Optional
File size: 6n bytes	Update activity: low	

Access Conditions:

READ	CHV1
UPDATE	ADM
INVALIDATE	ADM
REHABILITATE	ADM

Bytes	Description	M/O	Length
1 to 6	Element 1 of co-operative net list	O	6 bytes
6n-5 to 6n	Element n of co-operative net list	O	6 bytes

- Co-operative Network List

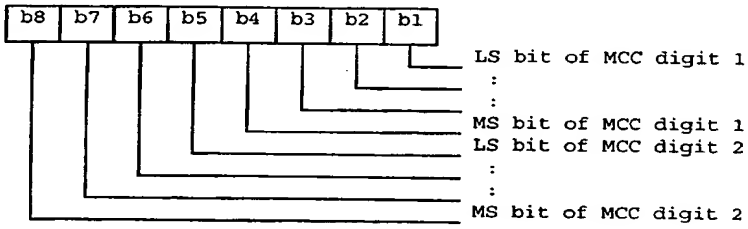
Contents:

MCC, MNC, network subset, service provider ID and corporate ID of co-operative networks.

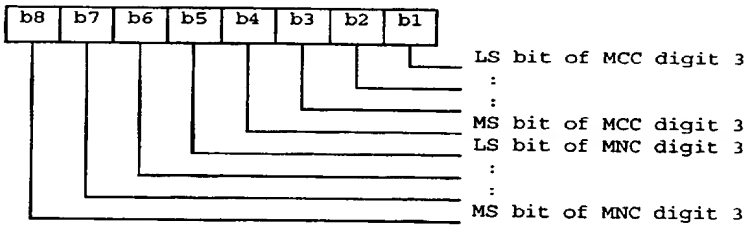
Coding:

For each 6 byte list element

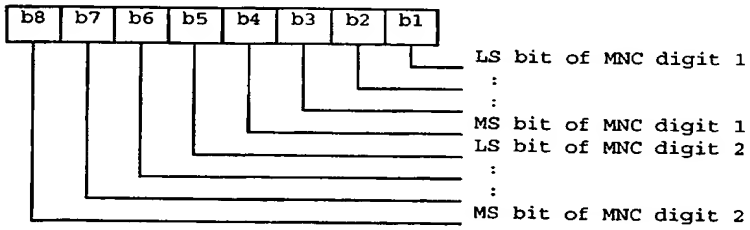
Byte 1:



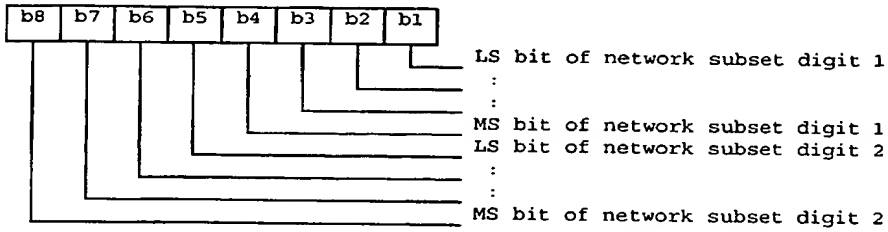
Byte 2:



Byte 3:

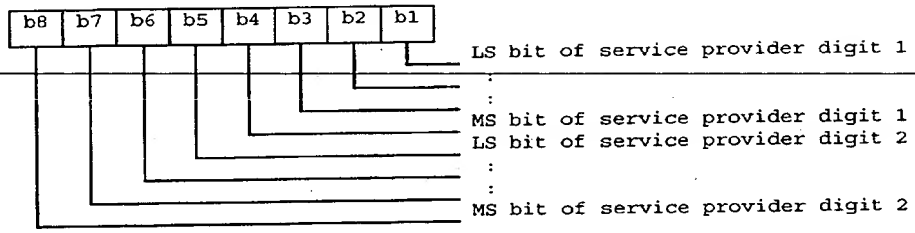


Byte 4:

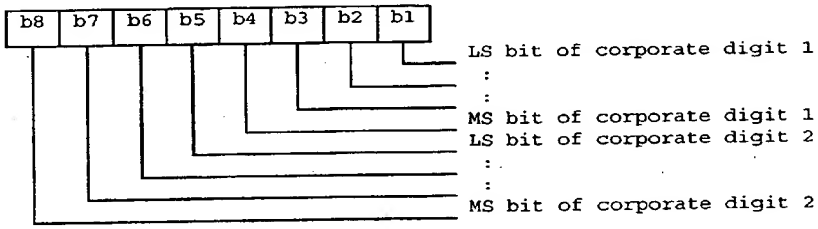


NOTE: Digit 3 of the MNC is placed directly after the MCC fields for compatibility between GSM and PCS 1900 PLMN structures.

Byte 5:



Byte 6:



For 2 digit MNCs digit 3 of this field shall be 'F'.
For 1 digit network subsets digit 2 of this field shall be 0.
Empty fields shall be coded with 'FF'.
The end of the list is delimited by the first MCC field coded 'FFF'.

10.3.31 EF_{NIA}(Network's Indication of Alerting)

This EF contains categories and associated text related to the Network's indication of alerting in the MS service defined in GSM 02.07 [3].

Identifier: '6F51'	Structure: linear fixed	Optional
Record length : X+1 bytes	Update activity: low	

Access Conditions:

READ	CHV1
UPDATE	ADM
INVALIDATE	ADM
REHABILITATE	ADM

Bytes	Description	M/O	Length
1	Alerting category	M	1 byte
2 to X+1	Informative text	M	X bytes

- Alerting category
  Contents:
  category of alerting for terminating traffic.
  Coding:
  according to GSM 04.08 [15]. Value 'FF' means that no information on alerting category is available.

- Informative text
  Contents:
  text describing the type of terminating traffic associated with the category.
  Coding:
  see the coding of the Alpha Identifier item of the EF_{ADN} (subclause 10.4.1). The maximum number of characters for this informative text is indicated in GSM 02.07 [3].

10.3.32 EF_{KcGPRS} (GPRS Ciphering key KcGPRS)

This EF contains the ciphering key KcGPRS and the ciphering key sequence number n for GPRS (see GSM 03.60 [32]).

Identifier: '6F52'	Structure: transparent	Mandatory
File size: 9 bytes	Update activity: high	

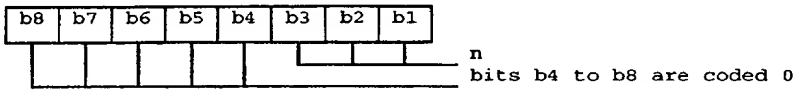
Access Conditions:

READ	CHV1
UPDATE	CHV1
INVALIDATE	ADM
REHABILITATE	ADM

Bytes	Description	M/O	Length
1 - 8	Ciphering key KcGPRS	M	8 bytes
9	Ciphering key sequence number n for GPRS	M	1 byte

- Ciphering key KcGPRS
  Coding:
  The least significant bit of KcGPRS is the least significant bit of the eighth byte. The most significant bit of KcGPRS is the most significant bit of the first byte.

- Ciphering key sequence number n for GPRS
  Coding:



NOTE: GSM 04.08 [15] defines the value of n=111 as "key not available". Therefore the value '07' and not 'FF' should be present following the administrative phase.

10.3.33 $EF_{LOCIGPRS}$ (GPRS location information)

This EF contains the following Location Information:

- Packet Temporary Mobile Subscriber Identity (P-TMSI)
- Packet Temporary Mobile Subscriber Identity signature value (P-TMSI signature value)
- Routing Area Information (RAI)
- Routing Area update status

Identifier: '6F53'	Structure: transparent	Mandatory
File size: 14 bytes	Update activity: high	

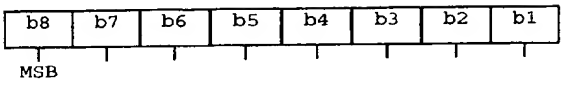
Access Conditions:

READ	CHV1
UPDATE	CHV1
INVALIDATE	ADM
REHABILITATE	ADM

Bytes	Description	M/O	Length
1 - 4	P-TMSI	M	4 bytes
5 – 7	P-TMSI signature value	M	3 bytes
8 - 13	RAI	M	6 bytes
14	Routing Area update status	M	1 byte

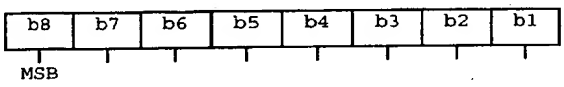
- P-TMSI
  Contents: Packet Temporary Mobile Subscriber Identity
  Coding: according to GSM 04.08 [15].

  Byte 1: first byte of P-TMSI



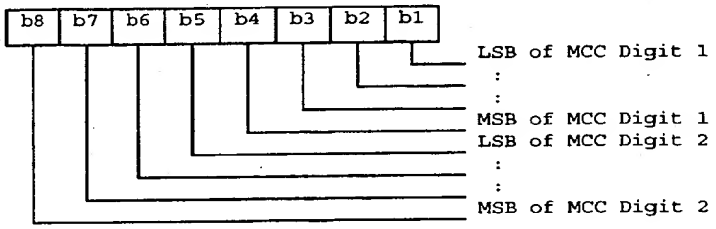
- P-TMSI signature value
  Contents: Packet Temporary Mobile Subscriber Identity signature value
  Coding: according to GSM 04.08 [15].

  Byte 1: first byte of P-TMSI signature value

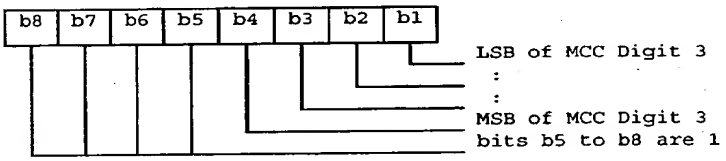


- RAI
  Contents: Routing Area Information
  Coding: according to GSM 04.08 [15].

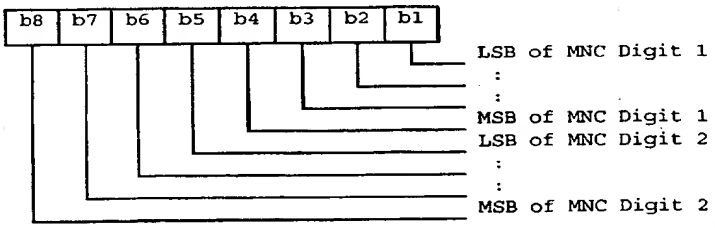
  Byte 5: first byte of RAI



  Byte 6: second byte of RAI (MCC continued)



  Byte 7: third byte of RAI (MNC)



  Byte 8: fourth byte of RAI (LAC)
  Byte 9: fifth byte of RAI (LAC continued)
  Byte 10: sixth byte of RAI (RAC)- Routing update status

- Routing update status
  Contents: status of location update according to GSM 04.08 [15].
  Coding:
  Byte 12:

Bits:	b3	b2	b1	
0	0	0	:	updated
0	0	1	:	not updated
0	1	0	:	PLMN not allowed
0	1	1	:	Routing Area not allowed
1	1	1	:	reserved

  Bits b4 to b8 are RFU (see subclause 9.3).

10.4 Contents of files at the telecom level

The EFs in the Dedicated File $DF_{TELECOM}$ contain service related information.

10.4.1 EF_{ADN} (Abbreviated dialling numbers)

This EF contains Abbreviated Dialling Numbers (ADN) and/or Supplementary Service Control strings (SSC). In addition it contains identifiers of associated network/bearer capabilities and identifiers of extension records. It may also contain an associated alpha-tagging.

Identifier: '6F3A'	Structure: linear fixed	Optional
Record length: X+14 bytes	Update activity: low	

Access Conditions:

READ	CHV1
UPDATE	CHV1
INVALIDATE	CHV2
REHABILITATE	CHV2

Bytes	Description	M/O	Length
1 to X	Alpha Identifier	O	X bytes
X+1	Length of BCD number/SSC contents	M	1 byte
X+2	TON and NPI	M	1 byte
X+3 to X+12	Dialling Number/SSC String	M	10 bytes
X+13	Capability/Configuration Identifier	M	1 byte
X+14	Extension1 Record Identifier	M	1 byte

- Alpha Identifier

  Contents:

  Alpha-tagging of the associated dialling number.

  Coding:

  this alpha-tagging shall use either
  - the SMS default 7-bit coded alphabet as defined in GSM 03.38 [12] with bit 8 set to 0. The alpha identifier shall be left justified. Unused bytes shall be set to 'FF'.
  - one of the UCS2 coded options as defined in Annex B.

NOTE 1: The value of X may be from zero to 241. Using the command GET RESPONSE the ME can determine the value of X.

- Length of BCD number/SSC contents

  Contents:

  this byte gives the number of bytes of the following two data items containing actual BCD number/SSC information. This means that the maximum value is 11, even when the actual ADN/SSC information length is greater than 11. When an ADN/SSC has extension, it is indicated by the extension1 identifier being unequal to 'FF'. The remainder is stored in the EF_{EXT1} with the remaining length of the additional data being coded in the appropriate additional record itself (see subclause 10.4.10).

  Coding:

  according to GSM 04.08 [15].

- TON and NPI

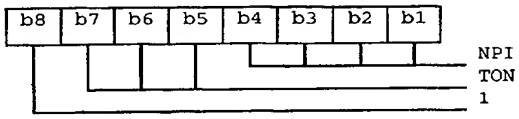
  Contents:

  Type of number (TON) and numbering plan identification (NPI).

  Coding:

  according to GSM 04.08 [15]. If the Dialling Number/SSC String does not contain a dialling number, e.g. a control string deactivating a service, the TON/NPI byte shall be set to 'FF' by the ME (see note 2).

NOTE 2: If a dialling number is absent, no TON/NPI byte is transmitted over the radio interface (see GSM 04.08 [15]). Accordingly, the ME should not interpret the value 'FF' and not send it over the radio interface.



- Dialling Number/SSC String

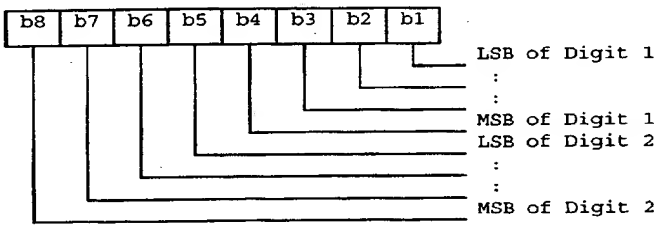
Contents:

up to 20 digits of the telephone number and/or SSC information.

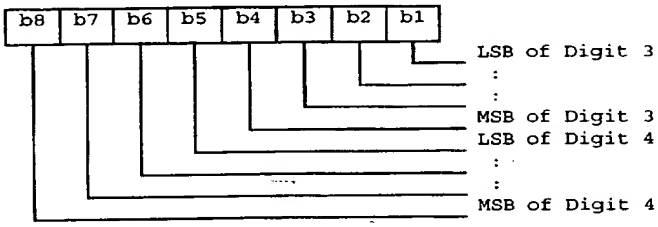
Coding:

according to GSM 04.08 [15] , GSM 02.30 [8] and the extended BCD-coding (see table 12). If the telephone number or SSC is longer than 20 digits, the first 20 digits are stored in this data item and the remainder is stored in an associated record in the EF_{EXT1}. The record is identified by the Extension1 Record Identifier. If ADN/SSC require less than 20 digits, excess nibbles at the end of the data item shall be set to 'F'. Where individual dialled numbers, in one or more records, of less than 20 digits share a common appended digit string the first digits are stored in this data item and the common digits stored in an associated record in the EF_{EXT1}. The record is identified by the Extension 1 Record Identifier. Excess nibbles at the end of the data item shall be set to 'F'.

Byte X+3



Byte X+4:



etc.

- Capability/Configuration Identifier

Contents:

capability/configuration identification byte. This byte identifies the number of a record in the EF_{CCP} containing associated capability/configuration parameters required for the call. The use of this byte is optional. If it is not used it shall be set to 'FF'.

Coding:

binary.

- Extension1 Record Identifier

Contents:

extension1 record identification byte. This byte identifies the number of a record in the EF_{EXT1} containing an associated called party subaddress or additional data. The use of this byte is optional. If it is not used it shall be set to 'FF'.

If the ADN/SSC requires both additional data and called party subaddress, this byte identifies the additional record. A chaining mechanism inside EF_{EXT1} identifies the record of the appropriate called party subaddress (see subclause 10.4.10).

Coding:

binary.

NOTE 3: As EF_{ADN} is part of the $DF_{TELECOM}$ it may be used by GSM and also other applications in a multi-application card. If the non-GSM application does not recognize the use of Type of Number (TON) and Number Plan Identification (NPI), then the information relating to the national dialling plan must be held within the data item dialling number/SSC and the TON and NPI fields set to UNKNOWN. This format would be acceptable for GSM operation and also for the non-GSM application where the TON and NPI fields shall be ignored.

Example: SIM storage of an International Number using E.164 [19] numbering plan

	TON	NPI	Digit field
GSM application	001	0001	abc...
Other application compatible with GSM	000	0000	xxx...abc...

where "abc..." denotes the subscriber number digits (including its country code), and "xxx..." denotes escape digits or a national prefix replacing TON and NPI.

NOTE 4: When the ME acts upon the EF_{ADN} with a SEEK command in order to identify a character string in the alpha-identifier, it is the responsibility of the ME to ensure that the number of characters used as SEEK parameters are less than or equal to the value of X if the MMI allows the user to offer a greater number.

Table 12: Extended BCD coding

BCD Value	Character/Meaning
'0'	"0"
'9'	"9"
'A'	"*"
'B'	"#"
'C'	DTMF Control digit separator (GSM 02.07 [3])
'D'	"Wild" value This will cause the MMI to prompt the user for a single digit (see GSM 02.07 [3]).
'E'	Expansion digit ("Shift Key"). It has the effect of adding '10' to the following digit. The following BCD digit will hence be interpreted in the range of '10'-'1E'. The purpose of digits in this range is for further study.
'F'	Endmark e.g. in case of an odd number of digits

BCD values 'C', 'D' and 'E' are never sent across the radio interface.

NOTE 5: The interpretation of values 'D', 'E' and 'F' as DTMF digits is for further study.

NOTE 6: A second or subsequent 'C' BCD value will be interpreted as a 3 second PAUSE (see GSM 02.07 [3]).

10.4.2 EF_{FDN} (Fixed dialling numbers)

This EF contains Fixed Dialling Numbers (FDN) and/or Supplementary Service Control strings (SSC). In addition it contains identifiers of associated network/bearer capabilities and identifiers of extension records. It may also contain an associated alpha-tagging.

Identifier: '6F3B'	Structure: linear fixed	Optional
Record length: X+14 bytes	Update activity: low	

Access Conditions:

READ	CHV1
UPDATE	CHV2
INVALIDATE	ADM
REHABILITATE	ADM

Bytes	Description	M/O	Length
1 to X	Alpha Identifier	O	X bytes
X+1	Length of BCD number/SSC contents	M	1 byte
X+2	TON and NPI	M	1 byte
X+3 to X+12	Dialling Number/SSC String	M	10 bytes
X+13	Capability/Configuration Identifier	M	1 byte
X+14	Extension2 Record Identifier	M	1 byte

For contents and coding of all data items see the respective data items of the EF_{ADN} (subclause 10.4.1), with the exception that extension records are stored in the EF_{EXT2}.

NOTE: The value of X (the number of bytes in the alpha-identifier) may be different to the length denoted X in EF_{ADN}.

10.4.3 EF_{SMS} (Short messages)

This EF contains information in accordance with GSM 03.40 [13] comprising short messages (and associated parameters) which have either been received by the MS from the network, or are to be used as an MS originated message.

Identifier: '6F3C'	Structure: linear fixed	Optional
Record length: 176 bytes	Update activity: low	

Access Conditions:

READ	CHV1
UPDATE	CHV1
INVALIDATE	ADM
REHABILITATE	ADM

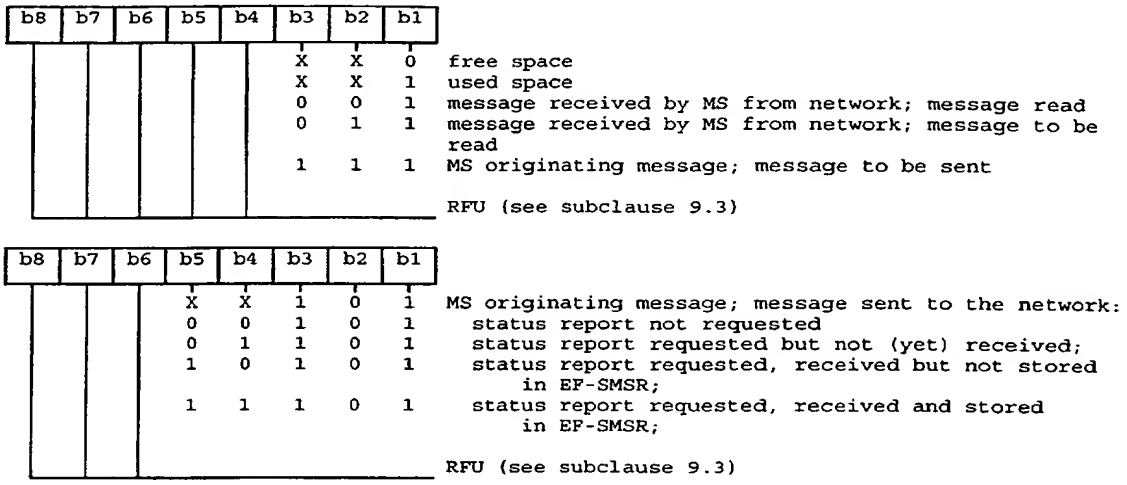
Bytes	Description	M/O	Length
1	Status	M	1 byte
2 to 176	Remainder	M	175 bytes

- Status

  Contents:

  Status byte of the record which can be used as a pattern in the SEEK command. For MS originating messages sent to the network, the status shall be updated when the MS receives a status report, or sends a successful SMS Command relating to the status report.

  Coding:



- Remainder

  Contents:

  This data item commences with the TS-Service-Centre-Address as specified in GSM 04.11 [16]. The bytes immediately following the TS-Service-Centre-Address contain an appropriate short message TPDU as specified in GSM 03.40 [13], with identical coding and ordering of parameters.

  Coding:

  according to GSM 03.40 [13] and GSM 04.11 [16]. Any TP-message reference contained in an MS originated message stored in the SIM, shall have a value as follows:

	Value of the TP-message-reference:
message to be sent:	'FF'
message sent to the network:	the value of TP-Message-Reference used in the message sent to the network.

  Any bytes in the record following the TPDU shall be filled with 'FF'.

  It is possible for a TS-Service-Centre-Address of maximum permitted length, e.g. containing more than 18 address digits, to be associated with a maximum length TPDU such that their combined length is 176 bytes. In this case the ME shall store in the SIM the TS-Service-Centre-Address and the TPDU in bytes 2-176 without modification, except for the last byte of the TPDU, which shall not be stored.

10.4.4 EF_{CCP} (Capability configuration parameters)

This EF contains parameters of required network and bearer capabilities and ME configurations associated with a call established using an abbreviated dialling number, a fixed dialling number, an MSISDN, a last number dialled, a service dialling number or a barred dialling number.

Identifier: '6F3D'	Structure: linear fixed	Optional
Record length: 14 bytes	Update activity: low	

Access Conditions:

READ	CHV1
UPDATE	CHV1
INVALIDATE	ADM
REHABILITATE	ADM

Bytes	Description	M/O	Length
1 to 10	Bearer capability information element	M	10 bytes
11 to 14	Bytes reserved - see below	M	4 bytes

- Bearer capability information element
  Contents and Coding:
  see GSM 04.08 [15]. The Information Element Identity (IEI) shall be excluded. i.e. the first byte of the EF_{CCP} record shall be Length of the bearer capability contents.

- Bytes 11-14 shall be set to 'FF' and shall not be interpreted by the ME.

10.4.5 EF_{MSISDN} (MSISDN)

This EF contains MSISDN(s) related to the subscriber. In addition it contains identifiers of associated network/bearer capabilities and identifiers of extension records. It may also contain an associated alpha-tagging.

Identifier: '6F40'	Structure: linear fixed	Optional
Record length: X+14 bytes	Update activity: low	

Access Conditions:

READ	CHV1
UPDATE	CHV1
INVALIDATE	ADM
REHABILITATE	ADM

Bytes	Description	M/O	Length
1 to X	Alpha Identifier	O	X bytes
X+1	Length of BCD number/SSC contents	M	1 byte
X+2	TON and NPI	M	1 byte
X+3 to X+12	Dialling Number/SSC String	M	10 bytes
X+13	Capability/Configuration Identifier	M	1 byte
X+14	Extension1 Record Identifier	M	1 byte

For contents and coding of all data items see the respective data items of EF_{ADN}.

NOTE 1: If the SIM stores more than one MSISDN number and the ME displays the MSISDN number(s) within the initialization procedure then the one stored in the first record shall be displayed with priority.

NOTE 2: The value of X (the number of bytes in the alpha-identifier) may be different to the length denoted X in EF_{ADN}.

10.4.6 EF_{SMSP} (Short message service parameters)

This EF contains values for Short Message Service header Parameters (SMSP), which can be used by the ME for user assistance in preparation of mobile originated short messages. For example, a service centre address will often be common to many short messages sent by the subscriber.

The EF consists of one or more records, with each record able to hold a set of SMS parameters. The first (or only) record in the EF shall be used as a default set of parameters, if no other record is selected.

To distinguish between records, an alpha-identifier may be included within each record, coded on Y bytes.

The SMS parameters stored within a record may be present or absent independently. When a short message is to be sent from the MS, the parameter in the SIM record, if present, shall be used when a value is not supplied by the user.

Identifier: '6F42'	Structure: linear fixed	Optional
Record length: 28+Y bytes	Update activity: low	

Access Conditions:

READ	CHV1
UPDATE	CHV1
INVALIDATE	ADM
REHABILITATE	ADM

Bytes	Description	M/O	Length
1 to Y	Alpha-Identifier	O	Y bytes
Y+1	Parameter Indicators	M	1 byte
Y+2 to Y+13	TP-Destination Address	M	12 bytes
Y+14 to Y+25	TS-Service Centre Address	M	12 bytes
Y+26	TP-Protocol Identifier	M	1 byte
Y+27	TP-Data Coding Scheme	M	1 byte
Y+28	TP-Validity Period	M	1 byte

Storage is allocated for all of the possible SMS parameters, regardless of whether they are present or absent. Any bytes unused, due to parameters not requiring all of the bytes, or due to absent parameters, shall be set to 'FF'.

- Alpha-Identifier
  Contents:
  Alpha Tag of the associated SMS-parameter.
  Coding:
  see subclause 10.4.1 (EF_{ADN}).

NOTE: The value of Y may be zero, i.e. the alpha-identifier facility is not used. By using the command GET RESPONSE the ME can determine the value of Y.

- Parameter Indicators
  Contents:
  Each of the default SMS parameters which can be stored in the remainder of the record are marked absent or present by individual bits within this byte.
  Coding:
  Allocation of bits:

Bit number	Parameter indicated
1	TP-Destination Address
2	TS-Service Centre Address
3	TP-Protocol Identifier
4	TP-Data Coding Scheme
5	TP-Validity Period
6	reserved, set to 1
7	reserved, set to 1
8	reserved, set to 1

Bit value	Meaning
0	Parameter present
1	Parameter absent

- TP-Destination Address
  Contents and Coding: As defined for SM-TL address fields in GSM 03.40 [13].

- TP-Service Centre Address
  Contents and Coding: As defined for RP-Destination address Centre Address in GSM 04.11 [16].

- TP-Protocol Identifier
  Contents and Coding: As defined in GSM 03.40 [13].

- TP-Data Coding Scheme
  Contents and Coding: As defined in GSM 03.38 [12].

- TP-Validity Period
  Contents and Coding: As defined in GSM 03.40 [13] for the relative time format.

10.4.7 EF_{SMSS} (SMS status)

This EF contains status information relating to the short message service.

The provision of this EF is associated with EF_{SMS}. Both files shall be present together, or both absent from the SIM.

Identifier: '6F43'	Structure: transparent	Optional
File size: 2+X bytes	Update activity: low	

Access Conditions:

READ	CHV1
UPDATE	CHV1
INVALIDATE	ADM
REHABILITATE	ADM

Bytes	Description	M/O	Length
1	Last Used TP-MR	M	1 byte
2	SMS "Memory Cap. Exceeded" Not. Flag	M	1 byte
3 to 2+X	RFU	O	X bytes

- Last Used TP-MR.
  Contents:
  the value of the TP-Message-Reference parameter in the last mobile originated short message, as defined in GSM 03.40 [13].
  Coding:
  as defined in GSM 03.40 [13].

- SMS "Memory Capacity Exceeded" Notification Flag.
  Contents:
  This flag is required to allow a process of flow control, so that as memory capacity in the MS becomes available, the Network can be informed. The process for this is described in GSM 03.40 [13].
  Coding:
  b1=1 means flag unset; memory capacity available
  b1=0 means flag set
  b2 to b8 are reserved and set to 1.

10.4.8 EF_{LND} (Last number dialled)

This EF contains the last numbers dialled (LND) and/or the respective supplementary service control strings (SSC). In addition it contains identifiers of associated network/bearer capabilities and identifiers of extension records. It may also contain associated alpha-tagging.

Identifier: '6F44'	Structure: cyclic	Optional
Record length: X+14 bytes	Update activity: low	

Access Conditions:

READ	CHV1
UPDATE	CHV1
INCREASE	NEVER
INVALIDATE	ADM
REHABILITATE	ADM

Bytes	Description	M/O	Length
1 to X	Alpha Identifier	O	X bytes
X+1	Length of BCD number/SSC contents	M	1 byte
X+2	TON and NPI	M	1 byte
X+3 to X+12	Dialling Number/SSC String	M	10 bytes
X+13	Capability/Configuration Identifier	M	1 byte
X+14	Extension1 Record Identifier	M	1 byte

Contents and coding: see subclause 10.4.1 (EF_{ADN}).

The value of X in EF_{LND} may be different to both the value of X in EF_{ADN} and of X in EF_{FDN}.

If the value of X in EF_{LND} is longer than the length of the α-tag of the number to be stored, then the ME shall pad the α-tag with 'FF'. If the value of X in EF_{LND} is shorter than the length of the α-tag of the number to be stored, then the ME shall cut off excessive bytes.

10.4.9 EF_{SDN} (Service Dialling Numbers)

This EF contains special service numbers (SDN) and/or the respective supplementary service control strings (SSC). In addition it contains identifiers of associated network/bearer capabilities and identifiers of extension records. It may also contain associated alpha-tagging.

Identifier: '6F49'	Structure: linear fixed	Optional
Record length: X+14 bytes	Update activity: low	

Access Conditions:

READ	CHV1
UPDATE	ADM
INVALIDATE	ADM
REHABILITATE	ADM

Bytes	Description	M/O	Length
1-X	Alpha identifier	O	X bytes
X+1	Length of BCD number/SSC contents	M	1 bytes
X+2	TON and NPI	M	1 byte
X+3-X+12	Dialling Number/SSC String	M	10 bytes
X+13	Capability/Configuration Identifier	M	1 byte
X+14	Extension3 Record Identifier	M	1 byte

For contents and coding of all data items see the respective data items of the EF_{ADN} (subclause 10.4.1), with the exception that extension records are stored in the EF_{EXT3}.

NOTE: The value of X (the number of bytes in the alpha-identifier) may be different to the length denoted X in EF_{ADN}.

10.4.10 EF_{EXT1} (Extension1)

This EF contains extension data of an ADN/SSC, an MSISDN, or an LND. Extension data is caused by:

- an ADN/SSC (MSISDN, LND) which is greater than the 20 digit capacity of the ADN/SSC (MSISDN, LND) Elementary File or where common digits are required to follow an ADN/SSC string of less than 20 digits. The remainder is stored in this EF as a record, which is identified by a specified identification byte inside the ADN/SSC (MSISDN, LND) Elementary File. The EXT1 record in this case is specified as additional data;
- an associated called party subaddress. The EXT1 record in this case is specified as subaddress data.

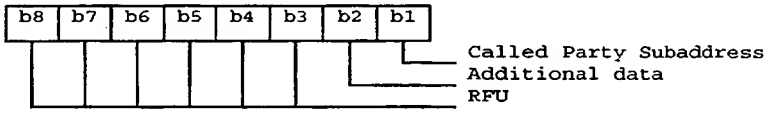
Identifier: '6F4A'	Structure: linear fixed	Optional
Record length: 13 bytes	Update activity: low	

Access Conditions:

READ	CHV1
UPDATE	CHV1
INVALIDATE	ADM
REHABILITATE	ADM

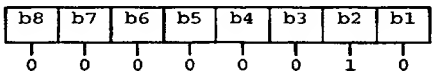
Bytes	Description	M/O	Length
1	Record type	M	1 byte
2 to 12	Extension data	M	11 bytes
13	Identifier	M	1 byte

- Record type
  Contents: type of the record
  Coding:



b3-b8 are reserved and set to 0;
a bit set to 1 identifies the type of record;
only one type can be set;
'00' indicates the type "unknown".

The following example of coding means that the type of extension data is "additional data":



- Extension data
  Contents: Additional data or Called Party Subaddress depending on record type.
  Coding:
  Case 1, Extension1 record is additional data:
  The first byte of the extension data gives the number of bytes of the remainder of ADN/SSC (respectively MSISDN, LND). The coding of remaining bytes is BCD, according to the coding of ADN/SSC (MSISDN, LND). Unused nibbles at the end have to be set to 'F'. It is possible if the number of additional digits exceeds the capacity of the additional record to chain another record inside the EXT1 Elementary File by the identifier in byte 13.
  Case 2, Extension1 record is Called Party Subaddress:
  The subaddress data contains information as defined for this purpose in GSM 04.08 [15]. All information defined in GSM 04.08, except the information element identifier, shall be stored in the SIM. The length of this subaddress data can be up to 22 bytes. In those cases where two extension records are needed, these records are chained by the identifier field. The extension record containing the first part of the called party subaddress points to the record which contains the second part of the subaddress.

- Identifier
  Contents: identifier of the next extension record to enable storage of information longer than 11 bytes.
  Coding: record number of next record. 'FF' identifies the end of the chain.

Example of a chain of extension records being associated to an ADN/SSC. The extension1 record identifier (Byte 14+X) of ADN/SSC is set to 3.

No of Record	Type	Extension Data	Next	Record
:	:	:	:	
:	:	:	:	
Record 3	'02'	xx xx	'06'	
Record 4	'xx'	xx xx	'xx'	
Record 5	'01'	xx xx	'FF'	
Record 6	'01'	xx xx	'05'	
:	:	:	:	
:	:	:	:	

In this example ADN/SSC is associated to additional data (record 3) and a called party subaddress whose length is more than 11 bytes (records 6 and 5).

10.4.11 EF_{EXT2} (Extension2)

This EF contains extension data of an FDN/SSC (see EXT2 in 10.4.2).

Identifier: '6F4B'	Structure: linear fixed	Optional
Record length: 13 bytes	Update activity: low	

Access Conditions:

READ	CHV1
UPDATE	CHV2
INVALIDATE	ADM
REHABILITATE	ADM

Bytes	Description	M/O	Length
1	Record type	M	1 byte
2 to 12	Extension data	M	11 bytes
13	Identifier	M	1 byte

For contents and coding see subclause 10.4.10 (EF_{EXT1}).

10.4.12 EF_{EXT3} (Extension3)

This EF contains extension data of an SDN (see EXT3 in 10.4.9).

Identifier: '6F4C'	Structure: linear fixed	Optional
Record length: 13 bytes	Update activity: low	

Access Conditions:

READ	CHV1
UPDATE	ADM
INVALIDATE	ADM
REHABILITATE	ADM

Bytes	Description	M/O	Length
1	Record type	M	1 byte
2 to 12	Extension data	M	11 bytes
13	Identifier	M	1 byte

For contents and coding see subclause 10.4.10 EF_{EXT1}.

10.4.13 EF_{BDN} (Barred Dialling Numbers)

This EF contains Barred Dialling Numbers (BDN) and/or Supplementary Service Control strings (SSC). In addition it contains identifiers of associated network/bearer capabilities and identifiers of extension records. It may also contain an associated alpha-tagging.

Identifier: '6F4D'	Structure: linear fixed	Optional
Record length: X+15 bytes	Update activity: low	

Access Conditions:

READ	CHV1
UPDATE	CHV2
INVALIDATE	CHV2
REHABILITATE	CHV2

Bytes	Description	M/O	Length
1 to X	Alpha Identifier	O	X bytes
X+1	Length of BCD number/SSC contents	M	1 byte
X+2	TON and NPI	M	1 byte
X+3 to X+12	Dialling Number/SSC String	M	10 bytes
X+13	Capability/Configuration Identifier	M	1 byte
X+14	Extension4 Record Identifier	M	1 byte
X+15	Comparison Method Information	M	1 byte

For contents and coding of all data items, except for the Comparison Method Information, see the respective data items of the EF_{ADN} (subclause 10.4.1), with the exception that extension records are stored in the EF_{EXT4}.

NOTE: The value of X (the number of bytes in the alpha-identifier) may be different to the length denoted X in EF_{ADN}.

- Comparison Method Information
  Contents:
  this byte describes the comparison method which is associated with that BDN. Its interpretation is not specified but it shall be defined by the operators implementing the BDN feature on their SIMs.
  Coding:
  binary; values from 0 to 255 are allowed.

10.4.14 EF_{EXT4} (Extension4)

This EF contains extension data of an BDN/SSC (see EXT4 in 10.4.13).

Identifier: '6F4E'	Structure: linear fixed	Optional
Record length: 13 bytes	Update activity: low	

Access Conditions:

READ	CHV1
UPDATE	CHV2
INVALIDATE	ADM
REHABILITATE	ADM

Bytes	Description	M/O	Length
1	Record type	M	1 byte
2 to 12	Extension data	M	11 bytes
13	Identifier	M	1 byte

For contents and coding see subclause 10.4.10 EF_{EXT1}.

10.4.15 EF_{SMSR} (Short message status reports)

This EF contains information in accordance with GSM 03.40 [13] comprising short message status reports which have been received by the MS from the network.

Each record is used to store the status report of a short message in a record of EF_{SMS}. The first byte of each record is the link between the status report and the corresponding short message in EF_{SMS}.

Identifier: '6F47'	Structure: linear fixed	Optional
Record length: 30 bytes	Update activity: low	

Access Conditions:

READ	CHV1
UPDATE	CHV1
INVALIDATE	ADM
REHABILITATE	ADM

Bytes	Description	M/O	Length
1	SMS record identifier	M	1
2 - 30	SMS status report	M	29 bytes

- SMS record identifier

  Contents:

  This data item identifies the corresponding SMS record in EF_{SMS}, e.g. if this byte is coded '05' then this status report corresponds to the short message in record #5 of EF_{SMS}.

  Coding:

  '00' - empty record

  '01' - 'FF' - record number of the corresponding SMS in EF_{SMS}.

- SMS status report

  Contents:

  This data item contains the SMS-STATUS-REPORT TPDU as specified in GSM 03.40 [13], with identical coding and ordering of parameters.

  Coding:

  according to GSM 03.40 [13]. Any bytes in the record following the TPDU shall be filled with 'FF'.

10.5 Files of GSM (figure 8)

This subclause contains a figure depicting the file structure of the SIM. DF_{GSM} shall be selected using the identifier '7F20'. If selection by this means fails, then DCS 1800 MEs shall, and optionally GSM MEs may then select DF_{GSM} with '7F21'.

NOTE 1: The selection of the GSM application using the identifier '7F21', if selection by means of the identifier '7F20' fails, is to ensure backwards compatibility with those Phase 1 SIMs which only support the DCS 1800 application using the Phase 1 directory $DF_{DCS1800}$ coded '7F21'.

NOTE 2: To ensure backwards compatibility with those Phase 1 DCS 1800 MEs which have no means to select DF_{GSM} two options have been specified. These options are given in GSM 09.91 [17].

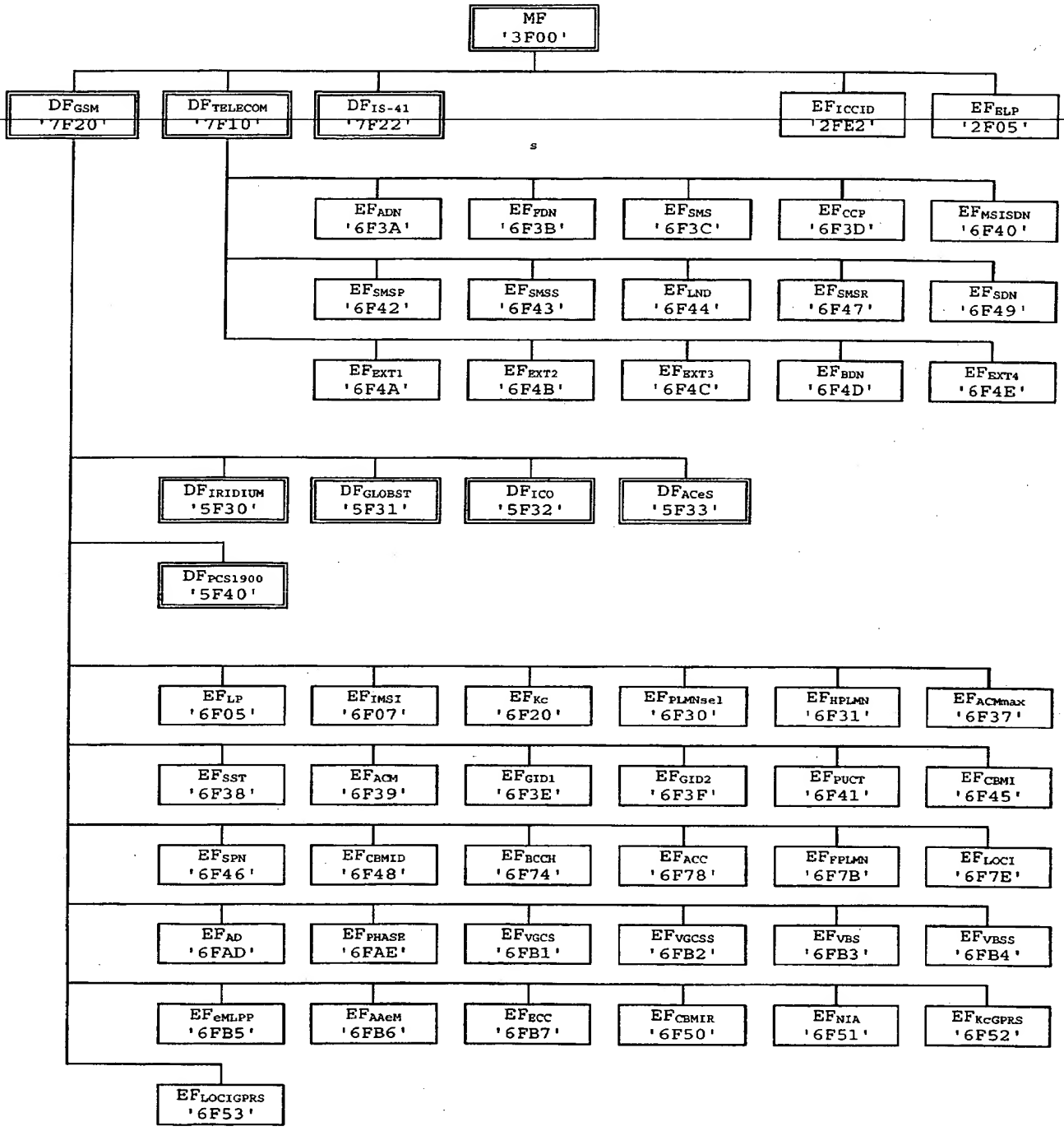


Figure 8: File identifiers and directory structures of GSM

11 Application protocol

When involved in GSM administrative management operations, the SIM interfaces with appropriate terminal equipment. These operations are outside the scope of the present document.

When involved in GSM network operations the SIM interfaces with an ME with which messages are exchanged. A message can be a command or a response.

- A GSM command/response pair is a sequence consisting of a command and the associated response.
- A GSM procedure consists of one or more GSM command/response pairs which are used to perform all or part of an application-oriented task. A procedure shall be considered as a whole, that is to say that the corresponding task is achieved if and only if the procedure is completed. The ME shall ensure that, when operated according to the manufacturer's manual, any unspecified interruption of the sequence of command/response pairs which realize the procedure, leads to the abortion of the procedure itself.
- A GSM session of the SIM in the GSM application is the interval of time starting at the completion of the SIM initialization procedure and ending either with the start of the GSM session termination procedure, or at the first instant the link between the SIM and the ME is interrupted.

During the GSM network operation phase, the ME plays the role of the master and the SIM plays the role of the slave.

Some procedures at the SIM/ME interface require MMI interactions. The descriptions hereafter do not intend to infer any specific implementation of the corresponding MMI. When MMI interaction is required, it is marked "MMI" in the list given below.

Some procedures are not clearly user dependent. They are directly caused by the interaction of the MS and the network. Such procedures are marked "NET" in the list given below.

Some procedures are automatically initiated by the ME. They are marked "ME" in the list given below.

The list of procedures at the SIM/ME interface in GSM network operation is as follows:

General Procedures:

- Reading an EF	ME
- Updating an EF	ME
- Increasing an EF	ME

SIM management procedures:

- SIM initialization	ME
- GSM session termination	ME
- Emergency call codes request	ME
- Extended language preference request	ME
- Language preference request	ME
- Administrative information request	ME
- SIM service table request	ME
- SIM phase request	ME

CHV related procedures:

- CHV verification	MMI
- CHV value substitution	MMI
- CHV disabling	MMI
- CHV enabling	MMI
- CHV unblocking	MMI

GSM security related procedures:

- GSM algorithms computation	NET
- IMSI request	NET
- Access control information request	NET
- HPLMN search period request	NET
- Location Information	NET
- Cipher key	NET
- BCCH information	NET
- Forbidden PLMN information	NET

Subscription related procedures:

- Dialling Numbers (ADN, FDN, MSISDN, LND, SDN, BDN)	MMI/ME
- Short messages (SMS)	MMI
- Advice of Charge (AoC)	MMI
- Capability Configuration Parameters (CCP)	MMI
- PLMN Selector	MMI
- Cell Broadcast Message Identifier (CBMI)	MMI
- Group Identifier Level 1 (GID1)	MMI/ME
- Group Identifier Level 2 (GID2)	MMI/ME
- Service Provider Name (SPN)	ME
- Voice Group Call Service (VGCS)	MMI/ME
- Voice Broadcast Service (VBS)	MMI/ME
- Enhanced Multi Level Pre-emption and Priority (eMLPP)	MMI/ME
- Depersonalisation Control Keys	ME
- Short message status reports (SMSR)	MMI
- Network's indication of alerting	ME

SIM Application Toolkit related procedures:

- Data Download via SMS-CB (CBMID)	NET
- Data Download via SMS-PP	NET
- Menu selection	MMI
- Call Control	MMI/ME/NET
- Proactive SIM	MMI/ME/NET
- Mobile Originated Short Message control by SIM	MMI/ME/NET

The procedures listed in subclause 11.2 are basically required for execution of the procedures in subclauses 11.3, 11.4 and 11.5. The procedures listed in subclauses 11.3 and 11.4 are mandatory (see GSM 02.17 [6]). The procedures listed in 11.5 are only executable if the associated services, which are optional, are provided in the SIM. However, if the procedures are implemented, it shall be in accordance with subclause 11.5.

If a procedure is related to a specific service indicated in the SIM Service Table, it shall only be executed if the corresponding bits denote this service as "allocated and activated" (see subclause 10.3.7). In all other cases this procedure shall not start.

11.1 General procedures

11.1.1 Reading an EF

The ME selects the EF and sends a READ command. This contains the location of the data to be read. If the access condition for READ is fulfilled, the SIM sends the requested data contained in the EF to the ME. If the access condition is not fulfilled, no data will be sent and an error code will be returned.

11.1.2 Updating an EF

The ME selects the EF and sends an UPDATE command. This contains the location of the data to be updated and the new data to be stored. If the access condition for UPDATE is fulfilled, the SIM updates the selected EF by replacing the existing data in the EF with that contained in the command. If the access condition is not fulfilled, the data existing in the EF will be unchanged, the new data will not be stored, and an error code will be returned.

11.1.3 Increasing an EF

The ME selects the EF and sends an INCREASE command. This contains the value which has to be added to the contents of the last updated/increased record. If the access condition for INCREASE is fulfilled, the SIM increases the existing value of the EF by the data contained in the command, and stores the result. If the access condition is not fulfilled, the data existing in the EF will be unchanged and an error code will be returned.

NOTE: The identification of the data within an EF to be acted upon by the above procedures is specified within the command. For the procedures in subclauses 11.1.1 and 11.1.2 this data may have been previously identified using a SEEK command, e.g. searching for an alphanumeric pattern.

11.2 SIM management procedures

Phase 2 MEs shall support all SIMs which comply with the mandatory requirements of Phase 1, even if these SIMs do not comply with all the mandatory requirements of Phase 2. Furthermore, Phase 2 MEs shall take care of potential incompatibilities with Phase 1 SIMs which could arise through use of inappropriate commands or misinterpretation of response data. Particular note should be taken of making a false interpretation of RFU bytes in a Phase 1 SIM having contradictory meaning in Phase 2; e.g. indication of EF invalidation state.

11.2.1 SIM initialization

After SIM activation (see subclause 4.3.2), the ME selects the Dedicated File DF_{GSM} and optionally attempts to select EF_{ECC}. If EF_{ECC} is available, the ME requests the emergency call codes.

The ME requests the Extended Language Preference. The ME only requests the Language Preference (EF_{LP}) if at least one of the following conditions holds:

- EF_{ELP} is not available;
- EF_{ELP} does not contain an entry corresponding to a language specified in ISO 639[30];
- the ME does not support any of the languages in EF_{ELP}.

If both EFs are not available or none of the languages in the EFs is supported then the ME selects a default language. It then runs the CHV1 verification procedure.

If the CHV1 verification procedure is performed successfully, the ME then runs the SIM Phase request procedure.

For a SIM requiring PROFILE DOWNLOAD, then the ME shall perform the PROFILE DOWNLOAD procedure in accordance with GSM 11.14 [27]. When BDN is enabled on a SIM, the PROFILE DOWNLOAD procedure is used to indicate to the SIM whether the ME supports the "Call Control by SIM" facility. If so, then the SIM is able to allow the REHABILITATE command to rehabilitate EF_{IMSI} and EF_{LOCI}.

If the ME detects a SIM of Phase 1, it shall omit the following procedures relating to FDN and continue with the Administrative Information request. The ME may omit procedures not defined in Phase 1 such as HPLMN Search Period request.

For a SIM of Phase 2 or greater, GSM operation shall only start if one of the two following conditions is fulfilled:

- if EF_{IMSI} and EF_{LOCI} are not invalidated, the GSM operation shall start immediately;
- if EF_{IMSI} and EF_{LOCI} are invalidated, the ME rehabilitates these two EFs.

  MEs without FDN capability but with Call control by SIM facility shall not rehabilitate EF_{IMSI} and/or EF_{LOCI} if FDN is enabled in the SIM and therefore have no access to these EFs. GSM operation will therefore be prohibited;

  MEs without FDN capability and without Call control by SIM facility shall not rehabilitate EF_{IMSI} and/or EF_{LOCI} and therefore have no access to these EFs. GSM operation will therefore be prohibited.

  It is these mechanisms which are used for control of services n°3 and n°31 by the use of SIMs for these services which always invalidate these two EFs at least before the next command following selection of either EF.

NOTE: When FDN and BDN are both enabled, and if the ME supports FDN but does not support the Call control by SIM facility, the rehabilitation of EF_{IMSI} and EF_{LOCI} will not be successful because of a restriction mechanism of the REHABILITATE command linked to the BDN feature.

When EF_{IMSI} and EF_{LOCI} are successfully rehabilitated, if the FDN capability procedure indicates that:

i) FDN is allocated and activated in the SIM; and FDN is set "enabled", i.e. ADN "invalidated" or not activated; and the ME supports FDN;

or ii) FDN is allocated and activated in the SIM; and FDN is set "disabled", i.e. ADN "not invalidated";

or iii) FDN is not allocated or not activated;

then GSM operation shall start.

In all other cases GSM operation shall not start.

Afterwards, the ME runs the following procedures:

- Administrative Information request;
- SIM Service Table request;
- IMSI request;
- Access Control request;
- HPLMN Search Period request;
- PLMN selector request;
- Location Information request;
- Cipher Key request;
- BCCH information request;
- Forbidden PLMN request;
- CBMID request;
- Depersonalisation Control Keys request;
- Network's indication of alerting request.

If the SIM service table indicates that the proactive SIM service is active, then from this point onwards, the ME, if it supports the proactive SIM service, shall send STATUS commands at least every 30s during idle mode as well as during calls, in order to enable the proactive SIM to respond with a command. The SIM may send proactive commands (see GSM 11.14 [27]), including a command to change the interval between STATUS commands from the ME, when in idle mode. In-call requirements for STATUS for SIM Presence Detection are unchanged by this command.

After the SIM initialization has been completed successfully, the MS is ready for a GSM session.

11.2.2 GSM session termination

NOTE 1: This procedure is not to be confused with the deactivation procedure in subclause 4.3.2.

The GSM session is terminated by the ME as follows:

The ME runs all the procedures which are necessary to transfer the following subscriber related information to the SIM:

- Location Information update;
- Cipher Key update;
- BCCH information update;
- Advice of Charge increase;
- Forbidden PLMN update.

As soon as the SIM indicates that these procedures are completed, the ME/SIM link may be deactivated.

Finally, the ME deletes all these subscriber related information elements from its memory.

NOTE 2: If the ME has already updated any of the subscriber related information during the GSM Session, and the value has not changed until GSM session termination, the ME may omit the respective update procedure.

11.2.3 Emergency Call Codes

Request: The ME performs the reading procedure with EF_{ECC}.
Update: The ME performs the updating procedure with EF_{ECC}.

NOTE: The update procedure is only applicable when access conditions of ADM for update is set to ALW, CHV1 or CHV2.

11.2.4 Language preference

Request: The ME performs the reading procedure with EF_{LP}.
Update: The ME performs the updating procedure with EF_{LP}.

11.2.5 Administrative information request;

The ME performs the reading procedure with EF_{AD}.

11.2.6 SIM service table request

The ME performs the reading procedure with EF_{SST}.

11.2.7 SIM phase request

The ME performs the reading procedure with EF_{PHASE}.

11.2.8 SIM Presence Detection and Proactive Polling

As an additional mechanism, to ensure that the SIM has not been removed during a card session, the ME sends, at frequent intervals, a STATUS command during each call. A STATUS command shall be issued within all 30 second periods of inactivity on the SIM-ME interface during a call. Inactivity in this case is defined as starting at the end of the last communication or the last issued STATUS command. If no response data is received to this STATUS command, then the call shall be terminated as soon as possible but at least within 5 seconds after the STATUS command has been sent. If the DF indicated in response to a STATUS command is not the same as that which was indicated in the previous response, or accessed by the previous command, then the call shall be terminated as soon as possible but at least within 5 seconds after the response data has been received. This procedure shall be used in addition to a mechanical or other device used to detect the removal of a SIM.

If the ME supports the proactive SIM service, and the SIM has this service activated in its Service Table, then during idle mode the ME shall send STATUS commands to the SIM at intervals no longer than the interval negotiated with the SIM (see GSM 11.14 [27]).

11.2.9 Extended Language preference

Request: The ME performs the reading procedure with EF_{ELP}.
Update: The ME performs the updating procedure with EF_{ELP}.

11.3 CHV related procedures

A successful completion of one of the following procedures grants the access right of the corresponding CHV for the GSM session. This right is valid for all files within the GSM application protected by this CHV.

After a third consecutive presentation of a wrong CHV to the SIM, not necessarily in the same GSM session, the CHV status becomes "blocked" and if the CHV is "enabled", the access right previously granted by this CHV is lost immediately.

An access right is not granted if any of the following procedures are unsuccessfully completed or aborted.

11.3.1 CHV verification

The ME checks the CHV status.

In the case of CHV1 the following procedure applies:

If the CHV1 status is "blocked" and CHV1 is "enabled", the procedure ends and is finished unsuccessfully.

If the CHV1 status is "blocked" but CHV1 is "disabled", the procedure ends and is finished successfully. The ME shall, however, accept SIMs which do not grant access rights when CHV1 is "blocked" and "disabled". In that case ME shall consider those SIMs as "blocked".

If the CHV1 status is not "blocked" and CHV1 is "disabled", the procedure is finished successfully.

If the CHV1 status is not "blocked" and CHV1 is "enabled", the ME uses the VERIFY CHV function. If the CHV1 presented by the ME is equal to the corresponding CHV1 stored in the SIM, the procedure is finished successfully. If the CHV1 presented by the ME is not equal to the corresponding CHV1 stored in the SIM, the procedure ends and is finished unsuccessfully.

In the case of CHV2 the following procedure applies:

If the CHV2 status is "blocked", the procedure ends and is finished unsuccessfully.

If the CHV2 status is not "blocked", the ME uses the VERIFY CHV function. If the CHV2 presented by the ME is equal to the corresponding CHV2 stored in the SIM, the procedure is finished successfully. If the CHV2 presented by the ME is not equal to the corresponding CHV2 stored in the SIM, the procedure ends and is finished unsuccessfully.

11.3.2 CHV value substitution

The ME checks the CHV status. If the CHV status is "blocked" or "disabled", the procedure ends and is finished unsuccessfully.

If the CHV status is not "blocked" and the enabled/disabled indicator is set "enabled", the ME uses the CHANGE CHV function. If the old CHV presented by the ME is equal to the corresponding CHV stored in the SIM, the new CHV presented by the ME is stored in the SIM and the procedure is finished successfully.

If the old CHV and the CHV in memory are not identical, the procedure ends and is finished unsuccessfully.

11.3.3 CHV disabling

Requirement: Service n°1 "allocated and activated".

The ME checks the CHV1 status. If the CHV1 status is "blocked", the procedure ends and is finished unsuccessfully.

If the CHV1 status is not "blocked", the ME reads the CHV1 enabled/disabled indicator. If this is set "disabled", the procedure ends and is finished unsuccessfully.

If the CHV1 status is not "blocked" and the enabled/disabled indicator is set "enabled", the ME uses the DISABLE CHV function. If the CHV1 presented by the ME is equal to the CHV1 stored in the SIM, the status of CHV1 is set "disabled" and the procedure is finished successfully. If the CHV1 presented by the ME is not equal to the CHV1 stored in the SIM, the procedure ends and is finished unsuccessfully.

11.3.4 CHV enabling

The ME checks the CHV1 status. If the CHV1 status is "blocked", the procedure ends and is finished unsuccessfully.

If the CHV1 status is not "blocked", the ME reads the CHV1 enabled/disabled indicator. If this is set "enabled", the procedure ends and is finished unsuccessfully.

If the CHV1 status is not "blocked" and the enabled/disabled indicator is set "disabled", the ME uses the ENABLE CHV function. If the CHV1 presented by the ME is equal to the CHV1 stored in the SIM, the status of CHV1 is set "enabled" and the procedure is finished successfully. If the CHV presented by the ME is not equal to the CHV1 stored in the SIM, the procedure ends and is finished unsuccessfully.

11.3.5 CHV unblocking

The execution of the CHV unblocking procedure is independent of the corresponding CHV status, i.e. being blocked or not.

The ME checks the UNBLOCK CHV status. If the UNBLOCK CHV status is "blocked", the procedure ends and is finished unsuccessfully.

If the UNBLOCK CHV status is not "blocked", the ME uses the UNBLOCK CHV function. If the UNBLOCK CHV presented by the ME is equal to the corresponding UNBLOCK CHV stored in the SIM, the relevant CHV status becomes "unblocked" and the procedure is finished successfully. If the UNBLOCK CHV presented by the ME is not equal to the corresponding UNBLOCK CHV stored in the SIM, the procedure ends and is finished unsuccessfully.

11.4 GSM security related procedures

11.4.1 GSM algorithms computation

The ME selects DF_{GSM} and uses the RUN GSM ALGORITHM function (see 8.16). The response SRES-Kc is sent to the ME when requested by a subsequent GET RESPONSE command.

11.4.2 IMSI request

The ME performs the reading procedure with EF_{IMSI}.

11.4.3 Access control request

The ME performs the reading procedure with EF_{ACC}.

11.4.4 HPLMN search period request

The ME performs the reading procedure with EF_{HPLMN}.

11.4.5 Location information

Request: The ME performs the reading procedure with EF_{LOCI}.
Update: The ME performs the updating procedure with EF_{LOCI}.

11.4.6 Cipher key

Request: The ME performs the reading procedure with EF_{Kc}.
Update: The ME performs the updating procedure with EF_{Kc}.

11.4.7 BCCH information

Request: The ME performs the reading procedure with EF_{BCCH}.
Update: The ME performs the updating procedure with EF_{BCCH}.

11.4.8 Forbidden PLMN

Request: The ME performs the reading procedure with EF_{PLMN}.
Update: The ME performs the updating procedure with EF_{PLMN}.

11.5 Subscription related procedures

11.5.1 Dialling numbers

The following procedures may not only be applied to EF_{ADN} and its associated extension files EF_{CCP} and EF_{EXT1} as described in the procedures below, but also to EF_{FDN}, EF_{MSISDN}, EF_{LND}, EF_{BDN} and EF_{SDN} and their associated extension files. If these files are not allocated and activated, as denoted in the SIM service table, the current procedure shall be aborted and the appropriate EFs shall remain unchanged.

As an example, the following procedures are described as applied to ADN.

Requirement: Service n°2 "allocated and activated"
(Service n°3 for FDN,
Service n°9 for MSISDN,
Service n°13 for LND,
Service n°18 for SDN),
Service n°31 for BDN)

Update: The ME analyses and assembles the information to be stored as follows (the byte identifiers used below correspond to those in the description of the EFs in subclauses 10.4.1, 10.4.4 and 10.4.10):

i) The ME identifies the Alpha-tagging, Capability/Configuration Identifier and Extension1 Record Identifier.

ii) The dialling number/SSC string shall be analysed and allocated to the bytes of the EF as follows:

- if a "+" is found, the TON identifier is set to "International";
- if 20 or less "digits" remain, they shall form the dialling number/SSC string;
- if more than 20 "digits" remain, the procedure shall be as follows:

Requirement:
Service n°10 "allocated and activated"
(Service n°10 applies also for MSISDN and LND;
Service n°11 for FDN;
Service n°19 for SDN;
Service n°32 for BDN.)

The ME seeks for a free record in EF_{EXT1}. If an Extension1 record is not marked as "free", the ME runs the Purge procedure. If an Extension1 record is still unavailable, the procedure is aborted.

The first 20 "digits" are stored in the dialling number/SSC string. The value of the length of BCD number/SSC contents is set to the maximum value, which is 11. The Extension1 record identifier is coded with the associated record number in the EF_{EXT1}. The remaining digits are stored in the selected Extension1 record where the type of the record is set to "additional data". The first byte of the Extension1 record is set with the number of bytes of the remaining additional data. The number of bytes containing digit information is the sum of the length of BCD number/SSC contents of EF_{ADN} and byte 2 of all associated chained Extension1 records containing additional data (see subclauses 10.4.1 and 10.4.10).

iii) If a called party subaddress is associated to the ADN/SSC the procedure shall proceed as follows:

Requirement:
Service n°10 "allocated and activated"
(Service n°10 applies also for MSISDN and LND;
Service n°11 for FDN;
Service n°19 for SDN;
Service n°32 for BDN.)

If the length of the called party subaddress is less than or equal to 11 bytes (see GSM 04.08 [15] for coding):

The ME seeks for a free record in EF_{EXT1}. If an Extension1 record is not marked as "free", the ME runs the Purge procedure. If an Extension1 record is still unavailable, the procedure is aborted.

The ME stores the called party subaddress in the Extension1 record, and sets the Extension1 record type to "called party subaddress".

If the length of the called party subaddress is greater than 11 bytes (see GSM 04.08 [15] for coding):

The ME seeks for two free records in EF_{EXT1}. If no such two records are found, the ME runs the Purge procedure. If two Extension1 records are still unavailable, the procedure is aborted.

The ME stores the called party subaddress in the two Extension1 records. The identifier field in the Extension1 record containing the first part of the subaddress data is coded with the associated EF_{EXT1} record

number containing the second part of the subaddress data. Both Extension1 record types are set to "called party subaddress".

Once i), ii), and iii) have been considered the ME performs the updating procedure with EF_{ADN}. If the SIM has no available empty space to store the received ADN/SSC, or if the procedure has been aborted, the ME advises the user.

NOTE 1: For reasons of memory efficiency the ME is allowed to analyse all Extension1 records to recognize if the additional or subaddress data to be stored is already existing in EF_{EXT1}. In this case the ME may use the existing chain or the last part of the existing chain from more than one ADN (LND, MSISDN). The ME is only allowed to store extension data in unused records. If existing records are used for multiple access, the ME shall not change any data in those records to prevent corruption of existing chains.

Erasure: The ME sends the identification of the information to be erased. The content of the identified record in EF_{ADN} is marked as "free".

Request: The ME sends the identification of the information to be read. The ME shall analyse the data of EF_{ADN} (subclause 10.4.1) to ascertain, whether additional data is associated in EF_{EXT1} or EF_{CCP}. If necessary, then the ME performs the reading procedure on these EFs to assemble the complete ADN/SSC.

Purge: The ME shall access each EF which references EF_{EXT1} (EF_{EXT2}) for storage and shall identify records in these files using extension data (additional data or called party subaddress). Note that existing chains have to be followed to the end. All referred Extension1 (Extension2) records are noted by the ME. All Extension1 (Extension2) records not noted are then marked by the ME as "free" by setting the whole record to 'FF'.

NOTE 2: Dependent upon the implementation of the ME, and in particular the possibility of erasure of ADN/SSC records by Phase 1 MEs, which have no knowledge of the EF_{EXT1}, it is possible for Extension1 records to be marked as "used space" (not equal to 'FF'), although in fact they are no longer associated with an ADN/SSC record.

The following three procedures are only applicable to service n°3 (FDN).

FDN capability request. The ME has to check the state of service n°3, i.e. if FDN is "enabled" or "disabled". In case of enabled FDN, the ME has to switch to a restrictive terminal mode (see GSM 02.07). To ascertain the state of FDN, the ME checks in EF_{SST} whether or not ADN is activated. If ADN is not activated, service n°3 is enabled. If ADN is activated, the ME checks the response data of EF_{ADN}. If EF_{ADN} is invalidated, service n°3 is enabled. In all other cases service n°3 is disabled.

FDN disabling. The FDN disabling procedure requires that CHV2 verification procedure has been performed successfully and that ADN is activated. If not, FDN disabling procedure will not be executed successfully. To disable FDN capability, the ME rehabilitates EF_{ADN}. The invalidate/rehabilitate flag of EF_{ADN}, which is implicitly set by the REHABILITATE command, is at the same time the indicator for the state of the service n°3. If ADN is not activated, disabling of FDN is not possible and thus service n°3 is always enabled (see FDN capability request).

NOTE 3: If FDN is disabled (by rehabilitating EF_{ADN}) using an administrative terminal then the FDN disabling procedure of this administrative terminal need also to rehabilitate EF_{IMSI} and EF_{LOCI} to ensure normal operation of the SIM in a phase 1 ME or a phase 2 ME which does not support FDN.

FDN enabling. The FDN enabling procedure requires that CHV2 verification procedure has been performed successfully. If not, FDN enabling procedure will not be executed successfully. To enable FDN capability, the ME invalidates EF_{ADN}. The invalidate/rehabilitate flag of EF_{ADN}, which is implicitly cleared by the INVALIDATE command, is at the same time the indicator for the state of the service n°3 (see FDN capability request). If ADN is not activated, service n°3 is always enabled.

Invalidated ADNs may optionally still be readable and updatable depending on the file status (see clause 9.3)

The following three procedures are only applicable to service n°31 (BDN).

BDN capability request. The ME has to check the state of service n°31, i.e. if BDN is "enabled" or "disabled". BDN service is "enabled" only if service n°31 is allocated and activated, and EF_{BDN} is not invalidated. In all other cases, the BDN service is "disabled".

BDN disabling. The BDN disabling procedure requires that CHV2 verification procedure has been performed successfully. If not, BDN disabling procedure will not be executed successfully. To disable BDN capability, the ME invalidates EF_{BDN}. The invalidate/rehabilitate flag of EF_{BDN}, which is implicitly cleared by the INVALIDATE command, is at the same time the indicator for the state of the service n°31 (see BDN capability request).

BDN enabling. The BDN enabling procedure requires that CHV2 verification procedure has been performed successfully. If not, BDN enabling procedure will not be executed successfully. To enable BDN capability, the ME rehabilitates EF_{BDN}. The invalidate/rehabilitate flag of EF_{BDN}, which is implicitly set by the REHABILITATE command, is at the same time the indicator for the state of the service n°31 (see BDN capability request).

Invalidated BDNs (when BDN capability is disabled) may optionally still be readable and updatable depending on the file status (see clause 9.3).

11.5.2 Short messages

Requirement: Service n°4 "allocated and activated".

Request: The SIM seeks for the identified short message. If this message is found, the ME performs the reading procedure with EF_{SMS}.

If service n°35 is "allocated and activated" and the status of the SMS is '1D' (status report requested, received and stored in EF_{SMSR}), the ME performs the reading procedure with the corresponding record in EF_{SMSR}. If the ME does not find a corresponding record in EF_{SMSR}, then the ME shall update the status of the SMS with '19' (status report requested, received but not stored in EF_{SMSR}).

If the short message is not found within the SIM memory, the SIM indicates that to the ME.

Update: The ME looks for the next available area to store the short message. If such an area is available, it performs the updating procedure with EF_{SMS}.

If there is no available empty space in the SIM to store the received short message, a specific MMI will have to take place in order not to loose the message.

Erasure: The ME will select in the SIM the message area to be erased. Depending on the MMI, the message may be read before the area is marked as "free". After performing the updating procedure with EF_{SMS}, the memory allocated to this short message in the SIM is made available for a new incoming message. The memory of the SIM may still contain the old message until a new message is stored in this area.

If service n°35 is "allocated and activated" and the status of the SMS is '1D' (status report requested, received and stored in EF_{SMSR}), the ME performs the erasure procedure for EF_{SMSR} with the corresponding record in EF_{SMSR}.

11.5.3 Advice of Charge (AoC)

Requirement: Service n°5 "allocated and activated".

Accumulated Call Meter.

Request: The ME performs the reading procedure with EF_{ACM}. The SIM returns the last updated value of the ACM.

Initialization: The ME performs the updating procedure with EF_{ACM} using the new initial value.

Increasing: The ME performs the increasing procedure with EF_{ACM} sending the value which has to be added.

Accumulated Call Meter Maximum Value.

Request: The ME performs the reading procedure with EF_{ACMmax}.

Initialization: The ME performs the updating procedure with EF_{ACMmax} using the new initial maximum value.

Price per Unit and Currency Table (PUCT).

Request: The ME performs the reading procedure with EF_{PUCT}.

Update: The ME performs the updating procedure with EF_{PUCT}.

11.5.4 Capability configuration parameters

Requirement: Service n°6 "allocated and activated".
Request: The ME performs the reading procedure with EF_{CCP}.
Update: The ME performs the updating procedure with EF_{CCP}.
Erasure: The ME sends the identification of the requested information to be erased. The content of the identified record in EF_{CCP} is marked as "free".

11.5.5 PLMN selector

Requirement: Service n°7 "allocated and activated".
Request: The ME performs the reading procedure with $EF_{PLMNsel}$.
Update: The ME performs the updating procedure with $EF_{PLMNsel}$.

11.5.6 Cell broadcast message identifier

Requirement: Service n°14 "allocated and activated".
Request: The ME performs the reading procedure with EF_{CBMI}.
Update: The ME performs the updating procedure with EF_{CBMI}.

11.5.7 Group identifier level 1

Requirement: Service n°15 "allocated and activated".
Request: The ME performs the reading procedure with EF_{GID1}.

11.5.8 Group identifier level 2

Requirement: Service n°16 "allocated and activated".
Request: The ME performs the reading procedure with EF_{GID2}.

11.5.9 Service Provider Name

Requirement: Service n°17 "allocated and activated".
Request: The ME performs the reading procedure with EF_{SPN}.

11.5.10 Voice Group Call Services

Requirement: Service n°18 "allocated and activated".

Voice Group Call Service
Request: The ME performs the reading procedure with EFVGCS.

Voice Group Call Service Status
Request: The ME performs the reading procedure with EFVGCSS.
Update: The ME performs the updating procedure with EFVGCSS.

11.5.11 Voice Broadcast Services

Requirement: Service n°19 "allocated and activated".

Voice Broadcast Service
Request: The ME performs the reading procedure with EF_{VBS}.

Voice Broadcast Service Status
Request: The ME performs the reading procedure with EF_{VBSS}.
Update: The ME performs the updating procedure with EF_{VBSS}.

11.5.12 Enhanced Multi Level Pre-emption and Priority Service

Requirement: Service n°18 "allocated and activated".

Enhanced Multi Level Pre-emption and Priority
Request: The ME performs the reading procedure with EF_{eMLPP}.

Automatic Answer on eMLPP service
Request: The ME performs the reading procedure with EF_{AAeM}.
Update: The ME performs the updating procedure with EF_{AAeM}.

11.5.13 Cell Broadcast Message range identifier

Requirement: Service n°30 "allocated and activated".

Request: The ME performs the reading procedure with EF_{CBMIR}.
Update: The ME performs the updating procedure with EF_{CBMIR}.

11.5.14 Depersonalisation Control Keys

Requirement: Service n°33 "allocated and activated".

Request: The ME performs the reading procedure with EF_{DCK}.

11.5.15 Short message status report

Requirement: Service n°35 "allocated and activated".

Request: If the status of a stored short message indicates that there is a corresponding status report, the ME performs the seek function with EF_{SMSR} to identify the record containing the appropriate status report. The ME performs the reading procedure with EF_{SMSR}.

Update: If a status report is received, the ME first seeks within the SMS record identifiers of EF_{SMSR} for the same record number it used for the short message in EF_{SMS}. If such a record identifier is found in EF_{SMSR}, it is used for storage. If such a record identifier is not found, then the ME seeks for a free entry in EF_{SMSR} for storage. If no free entry is found the ME runs the Purge procedure with EF_{SMSR}. If there is still no free entry, the status report is not stored.

If the ME found an appropriate record in EF_{SMSR} for storage, it updates the record with the status report setting the record identifier in EF_{SMSR} to the appropriate record number of the short message in EF_{SMS}.

The status in EF_{SMS} is updated accordingly (see 10.4.3) by performing the update procedure with EF_{SMS}.

Erasure: The ME runs the update procedure with EF_{SMSR} by at least storing '00' in the first byte of the record. The ME may optionally update the following bytes with 'FF'.

Purge: The ME shall read the SMS record identifier (byte 1) of each record of EF_{SMSR}. With each record the ME checks the corresponding short messages in EF_{SMS}. If the status (byte 1) of the corresponding SMS is not equal '1D' (status report requested, received and stored in EF_{SMSR}), the ME shall perform the erasure procedure with the appropriate record in EF_{SMSR}.

11.5.16 Network's indication of alerting

Requirement: Service n°36 "allocated and activated".
Request: The ME performs the reading procedure with EF_{NIA}.

11.6 SIM Application Toolkit related procedures

SIM Application Toolkit is an optional feature. The higher level procedures, and contents and coding of the commands, are given in GSM 11.14 [27]. Procedures relating to the transmission of commands and responses across the SIM/ME interface are given in this section. A SIM or ME supporting SIM Application Toolkit shall conform to the requirements given in this section.

11.6.1 Initialization procedure

A SIM supporting SIM Application Toolkit shall indicate this through relevant data in EF_{Phase} and EF_{SST}, as defined in the relevant sections above.

An ME supporting SIM Application Toolkit shall perform initialization as defined in the SIM Initialization section above.

11.6.2 Proactive polling

An ME supporting proactive SIM (part of SIM Application Toolkit) shall support the polling procedure as defined above.

11.6.3 Support of commands

A SIM or ME supporting SIM Application Toolkit shall support the commands TERMINAL PROFILE, ENVELOPE, FETCH and TERMINAL RESPONSE.

These commands shall never be used if either the SIM or ME does not support SIM Application Toolkit. Therefore standard SIMs and MEs do not need to support these commands.

11.6.4 Support of response codes

A SIM or ME supporting SIM Application Toolkit shall support the response status words (SW1 SW2) '91 XX', '93 00' and '9E XX.

The SIM shall send '9E XX' only to an ME indicating in TERMINAL PROFILE that it supports the handling of these status words.

These responses shall never be used if either the SIM or ME does not support SIM Application Toolkit. Therefore standard SIMs and MEs do not need to support them.

11.6.5 Command-response pairs

Using the terminology where the ME issues a command and the SIM a response, ending in status words SW1 SW2, a command-response pair is considered as a single transaction. Each transaction is initiated by the ME and terminated by the SIM. One transaction must be completed before the next one can be initiated. This protocol applies to SIM Application Toolkit in the same way as it does to normal operation.

11.6.6 Independence of normal GSM and SIM Application Toolkit tasks

Normal GSM operation (relating to general, CHV related, GSM security related, and subscription related procedures) and SIM Application Toolkit operation shall be logically independent, both in the SIM and in the ME.

Specifically, this means:

- The currently selected EF and current record pointer in the normal GSM task shall remain unchanged, if still valid, as seen by the ME, irrespective of any SIM Application Toolkit activity.
- Between successive SIM Application Toolkit related command-response pairs, other normal GSM related command-response pairs can occur. The SIM Application Toolkit task status shall remain unchanged by these command-response pairs.

11.6.7 Use of BUSY status response

If for any reason the SIM Application Toolkit task of the SIM cannot process an ENVELOPE command issued by the ME at present (e.g. other SIM Application Toolkit processes are already running, and this additional one would cause an overload), the SIM can respond with a status response of '93 00'. The ME may re-issue the command at a later stage.

The BUSY status response has no impact on normal GSM operation.

11.6.8 Use of NULL procedure byte

The NULL procedure byte provides a mechanism for the SIM to obtain more time before supplying the response part of a command-response pair, during which time the ME is unable to send further commands to the SIM.

If a SIM Application Toolkit activity in the SIM runs for too long, this may prevent the ME from sending "normal GSM" commands which are time-critical, e.g. RUN GSM ALGORITHM. A MORE TIME command is defined in GSM 11.14 [27], which ensures that the SIM Application Toolkit task in the SIM gets more processing time, while at the same time freeing the SIM/ME interface. This should be used in preference to NULL procedure bytes ('60').

11.6.9 Using the TERMINAL PROFILE, ENVELOPE, and TERMINAL RESPONSE commands

These commands are part of the set used by SIM Application Toolkit. The use of the these commands, the occasions where they are required, and the command and response parameters associated with the commands, are specified in GSM 11.14 [27]. The ME completes the command parameters/data of the relevant command and sends the command to the SIM. The transmitted data is processed by the SIM in a specific way depending on the tag value in the command parameters.

A SIM or ME not supporting SIM Application Toolkit does not need to support these commands.

11.6.10 Using the FETCH command

This command is used by SIM Application Toolkit. The use of the this command, the occasions where it is required, and the command and response parameters associated with the command, are specified in GSM 11.14 [27]. It is similar in function to GET RESPONSE, in that it requests response parameters from the SIM, following a '91 XX' status response. The transmitted response data from the SIM is processed by the ME in a specific way depending on the tag value in the response parameters.

A SIM or ME not supporting SIM Application Toolkit does not need to support this command.

11.6.11 Data Download via SMS-CB

Requirement: Service n°25 "allocated and activated".

The ME shall perform the reading procedure with EF_{CBMID}. On receiving a cell broadcast message with an identifier which matches an identifier in EF_{CBMID}, the ME shall pass the CB message to the SIM using the ENVELOPE command. If a match is not found and service no. 14 is "allocated and activated", then the message identifier is checked against those in EF_{CBMI}.

11.6.12 Data Download via SMS-PP

Requirement: Service n°26 "allocated and activated".

The procedures and commands for Data Download via SMS-PP are defined in GSM 11.14 [27].

11.6.13 Menu selection

Requirement: Service n°27 "allocated and activated".

The procedures and commands for Menu Selection are defined in GSM 11.14 [27].

11.6.14 Call Control

Requirement: Service n°28 "allocated and activated".

The procedures and commands for Call Control are defined in GSM 11.14 [27]. It is mandatory for the ME to perform the procedures if it has indicated that it supports Call Control in the TERMINAL PROFILE command. When BDN is enabled, the Call control facility of the ME is used by the SIM to support the BDN service.

11.6.15 Proactive SIM

Requirement: Service n°29 "allocated and activated".

The procedures and commands for Proactive SIM, at the application level, are defined in GSM 11.14 [27].

11.6.16 Mobile Originated Short Message control by SIM

Requirement: Service n°37 "allocated and activated".

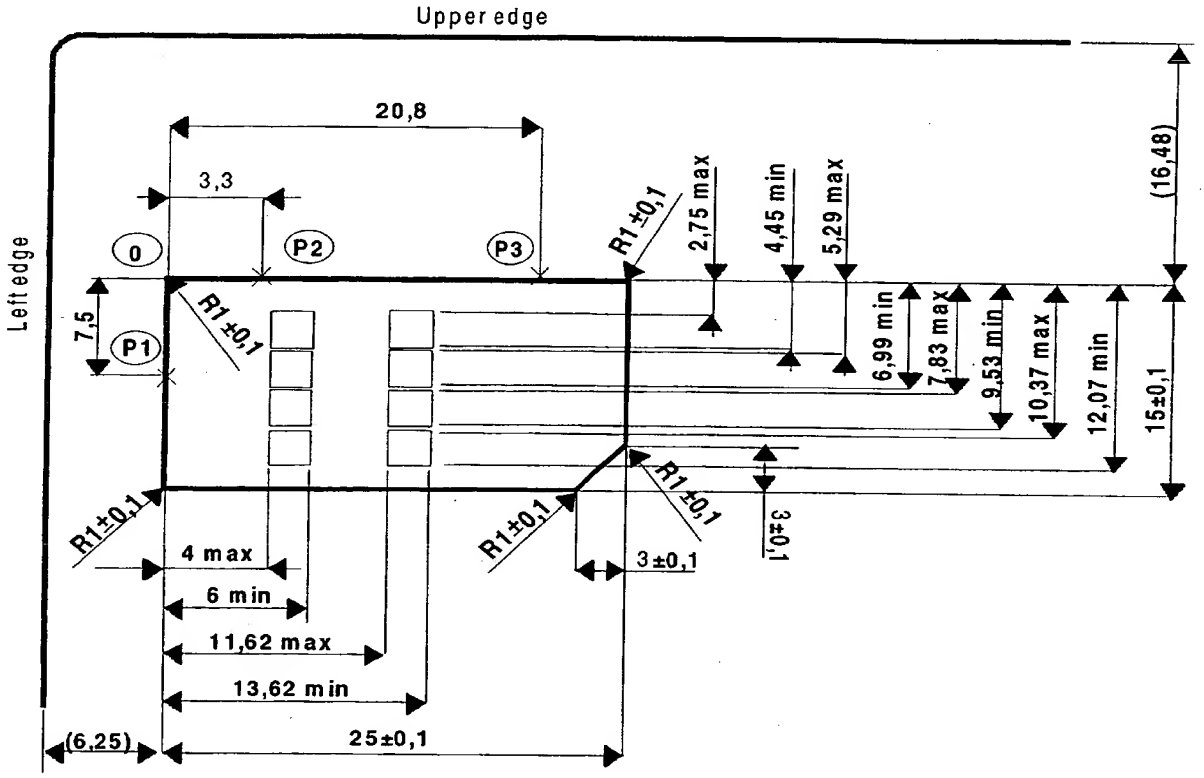
The procedures and commands for Mobile Originated Short Message control by SIM are defined in GSM 11.14 [27]. It is mandatory for the ME to perform the procedures if it has indicated that it supports Mobile Originated Short Message control by SIM in the TERMINAL PROFILE command.

11.6.17 SIM data download error

In case of an ENVELOPE for SIM data download, the SIM can respond with the status words '9E XX' to indicate that response data is available. The ME shall use the GET RESPONSE command to get the response data. The ME shall then send transparently to the network this response data, using the error procedure of the transport mechanism.

Annex A (normative): Plug-in SIM

This annex specifies the dimensions of the Plug-in SIM as well as the dimensions and location of the contacts of the Plug-in SIM. For further details of the Plug-in SIM see clause 4.



NOTE: The Plug-in SIM may be "obtained" by cutting away excessive plastic of an ID-1 SIM. The values in parenthesis in figure A.1 show the positional relationship between the Plug-in and the ID-1 SIM and are for information only.

Figure A.1: Plug-in SIM

Annex B (normative): Coding of Alpha fields in the SIM for UCS2

If 16 bit UCS2 characters as defined in ISO/IEC 10646 [31] are being used in an alpha field, the coding can take one of three forms. If the ME supports UCS2 coding of alpha fields in the SIM, the ME shall support all three coding schemes for character sets containing 128 characters or less; for character sets containing more than 128 characters, the ME shall at least support the first coding scheme. If the alpha field record contains GSM default alphabet characters only, then none of these schemes shall be used in that record. Within a record, only one coding scheme, either GSM default alphabet, or one of the three described below, shall be used.

1) If the first octet in the alpha string is '80', then the remaining octets are 16 bit UCS2 characters, with the more significant octet (MSO) of the UCS2 character coded in the lower numbered octet of the alpha field, and the less significant octet (LSO) of the UCS2 character is coded in the higher numbered alpha field octet, i.e. octet 2 of the alpha field contains the more significant octet (MSO) of the first UCS2 character, and octet 3 of the alpha field contains the less significant octet (LSO) of the first UCS2 character (as shown below). Unused octets shall be set to 'FF', and if the alpha field is an even number of octets in length, then the last (unusable) octet shall be set to 'FF'.

Example 1

Octet 1	Octet 2	Octet 3	Octet 4	Octet 5	Octet 6	Octet 7	Octet 8	Octet 9
'80'	$Ch1_{MSO}$	$Ch1_{LSO}$	$Ch2_{MSO}$	$Ch2_{LSO}$	$Ch3_{MSO}$	$Ch3_{LSO}$	'FF'	'FF'

2) If the first octet of the alpha string is set to '81', then the second octet contains a value indicating the number of characters in the string, and the third octet contains an 8 bit number which defines bits 15 to 8 of a 16 bit base pointer, where bit 16 is set to zero, and bits 7 to 1 are also set to zero. These sixteen bits constitute a base pointer to a "half-page" in the UCS2 code space, to be used with some or all of the remaining octets in the string. The fourth and subsequent octets in the string contain codings as follows; if bit 8 of the octet is set to zero, the remaining 7 bits of the octet contain a GSM Default Alphabet character, whereas if bit 8 of the octet is set to one, then the remaining seven bits are an offset value added to the 16 bit base pointer defined earlier, and the resultant 16 bit value is a UCS2 code point, and completely defines a UCS2 character.

Example 2

Octet 1	Octet 2	Octet 3	Octet 4	Octet 5	Octet 6	Octet 7	Octet 8	Octet 9
'81'	'05'	'13'	'53'	'95'	'A6'	'XX'	'FF'	'FF'

In the above example;

- Octet 2 indicates there 5 characters in the string
- Octet 3 indicates bits 15 to 8 of the base pointer, and indicates a bit pattern of 0hhh hhhh h000 0000 as the 16 bit base pointer number. Bengali characters for example start at code position 0980 (*0000 1001 1*000 0000), which is indicated by the coding '13' in octet 3 (shown by the italicised digits).
- Octet 4 indicates GSM Default Alphabet character '53', i.e. "S".
- Octet 5 indicates a UCS2 character offset to the base pointer of '15', expressed in binary as follows 001 0101, which, when added to the base pointer value results in a sixteen bit value of 0000 1001 1001 0101, i.e. '0995', which is the Bengali letter KA.

  Octet 8 contains the value 'FF', but as the string length is 5, this a valid character in the string, where the bit pattern 111 1111 is added to the base pointer, yielding a sixteen bit value of 0000 1001 1111 1111 for the UCS2 character (i.e. '09FF').

3) If the first octet of the alpha string is set to '82', then the second octet contains a value indicating the number of characters in the string, and the third and fourth octets contain a 16 bit number which defines the complete 16 bit base pointer to a "half-page" in the UCS2 code space, for use with some or all of the remaining octets in the string. The fifth and subsequent octets in the string contain codings as follows; if bit 8 of the octet is set to zero, the remaining 7 bits of the octet contain a GSM Default Alphabet character, whereas if bit 8 of the octet is set to one, the remaining seven bits are an offset value added to the base pointer defined in octets three and four, and the resultant 16 bit value is a UCS2 code point, and defines a UCS2 character.

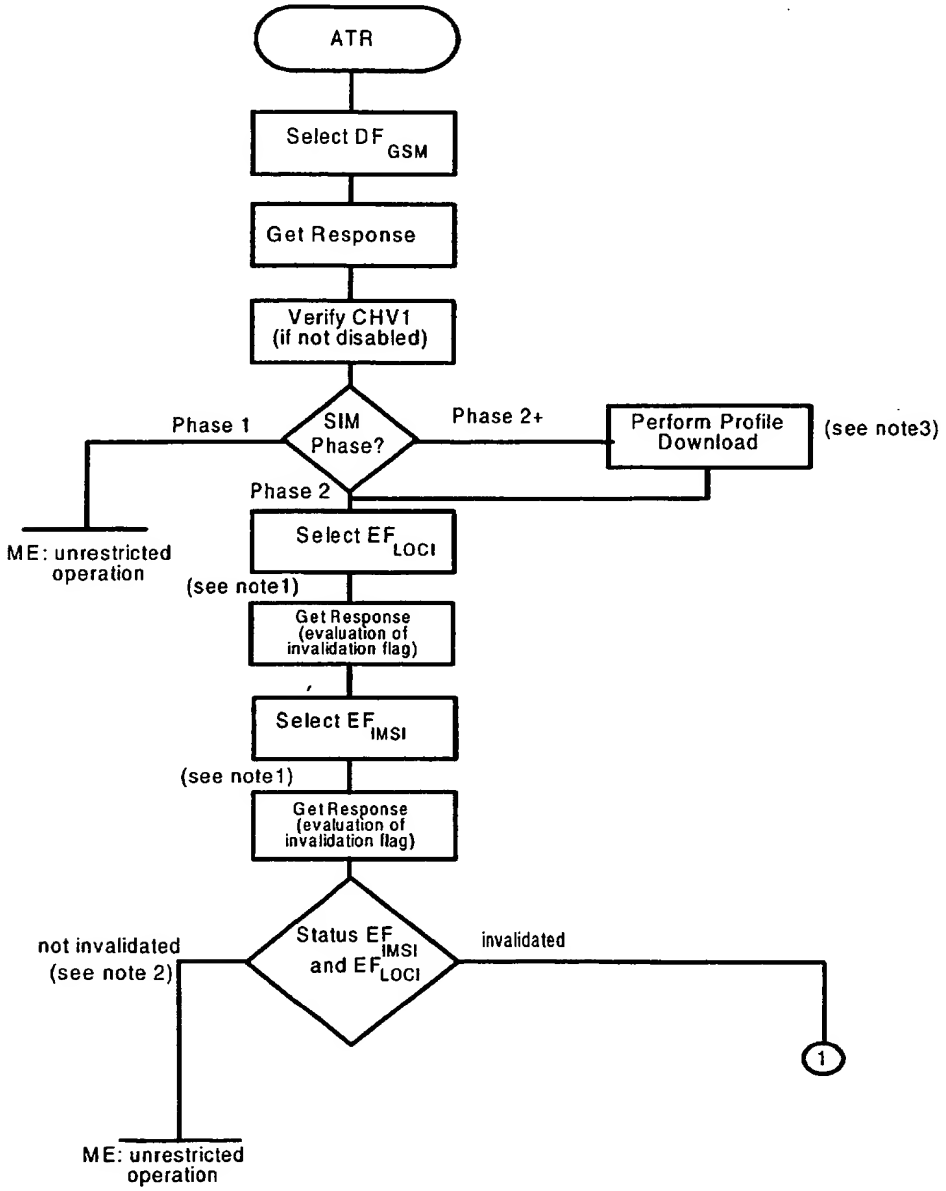
Example 3

Octet 1	Octet 2	Octet 3	Octet 4	Octet 5	Octet 6	Octet 7	Octet 8	Octet 9
'82'	'05'	'05'	'30'	'2D'	'82'	'D3'	'2D'	'31'

In the above example

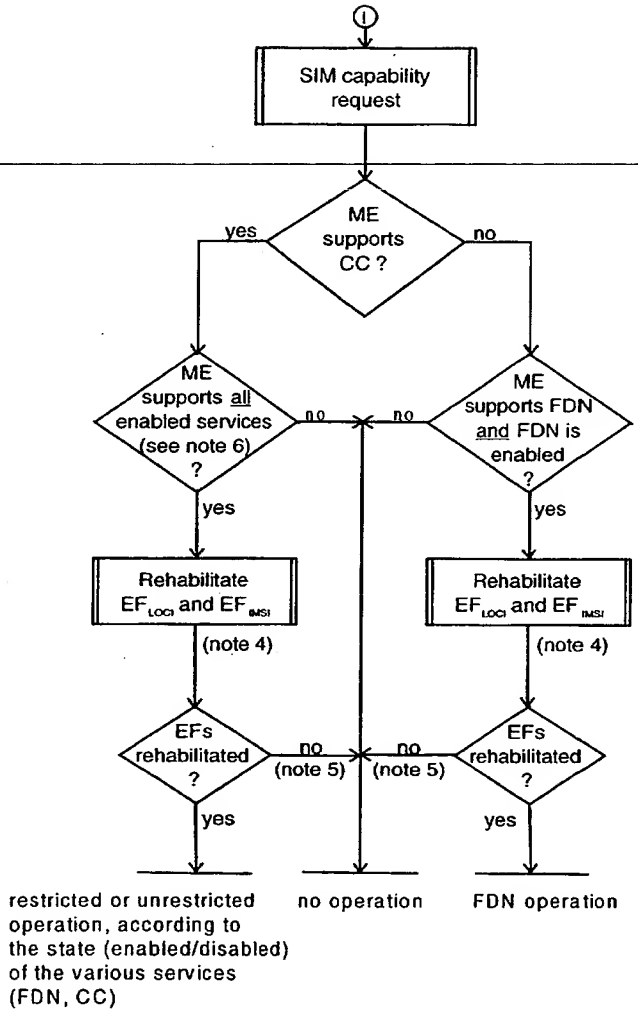
- Octet 2 indicates there are 5 characters in the string
- Octets 3 and 4 contain a sixteen bit base pointer number of '0530', pointing to the first character of the Armenian character set.
- Octet 5 contains a GSM Default Alphabet character of '2D', which is a dash "-".
- Octet 6 contains a value '82', which indicates it is an offset of '02' added to the base pointer, resulting in a UCS2 character code of '0532', which represents Armenian character Capital BEN.
- Octet 7 contains a value 'D3', an offset of '53', which when added to the base pointer results in a UCS2 code point of '0583', representing Armenian Character small PIWR.

Annex C (informative): FDN/BDN Procedures



NOTE 1: In case of enabled FDN and/or enabled BDN, the EF has been invalidated by the SIM at no later than this stage.
NOTE 2: Invalidation of only one of the two EFs is not allowed for FDN and BDN.
NOTE 3: For SIMs with enabled BDN this procedure is used to check whether the ME supports the Call Control by the SIM facility.

Figure C.1: Example of an Initialization Procedure of a FDN/BDN SIM (see 11.2.1)



Note 4: In case of "BDN enabled", the SIM only allows rehabilitation of the EF_{IMSI} and EF_{LOCI}, if the ME has indicated its CC-capability to the SIM (by PROFILE_DOWNLOAD).

Note 5: Possibility for future "restricting" services to use the internal SIM mechanism of invalidation of EF_{IMSI} and EF_{LOCI}.

Note 6: If the ME does not support all enabled services (e.g. FDN, BDN), it does not operate. In case of enabled BDN, the support of the "Call Control Feature" by the ME is sufficient for operation. For future use, there may be additional "restricting" services, which are not known to the ME. In that case the ME will perform the subsequent rehabilitation procedure but will fail to rehabilitate EF_{IMSI} and EF_{LOCI} (see note 4).

Figure C.1: Example of an Initialization Procedure of a FDN/BDN SIM (continued)

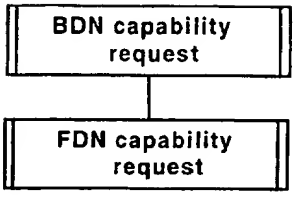


Figure C.2: SIM capability request

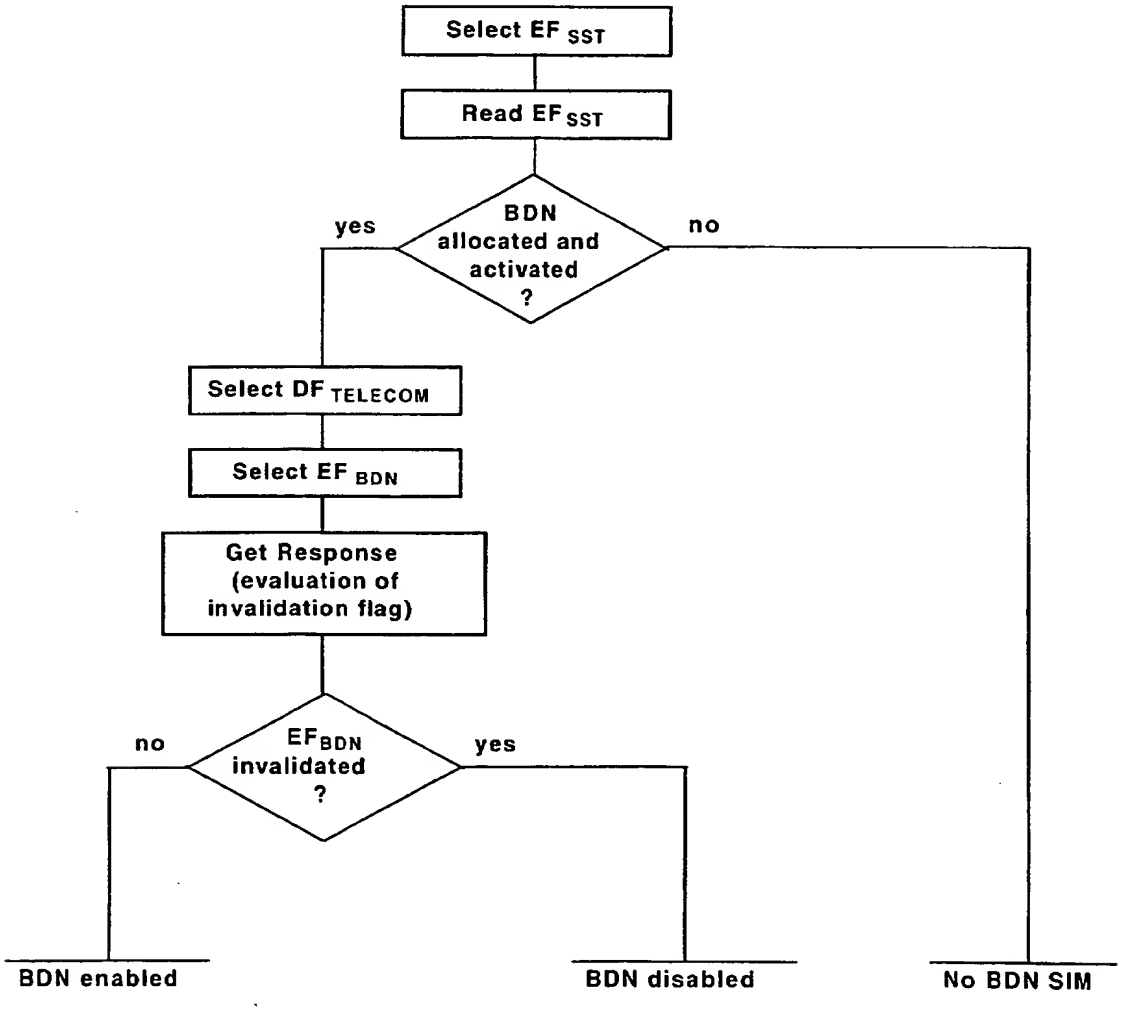
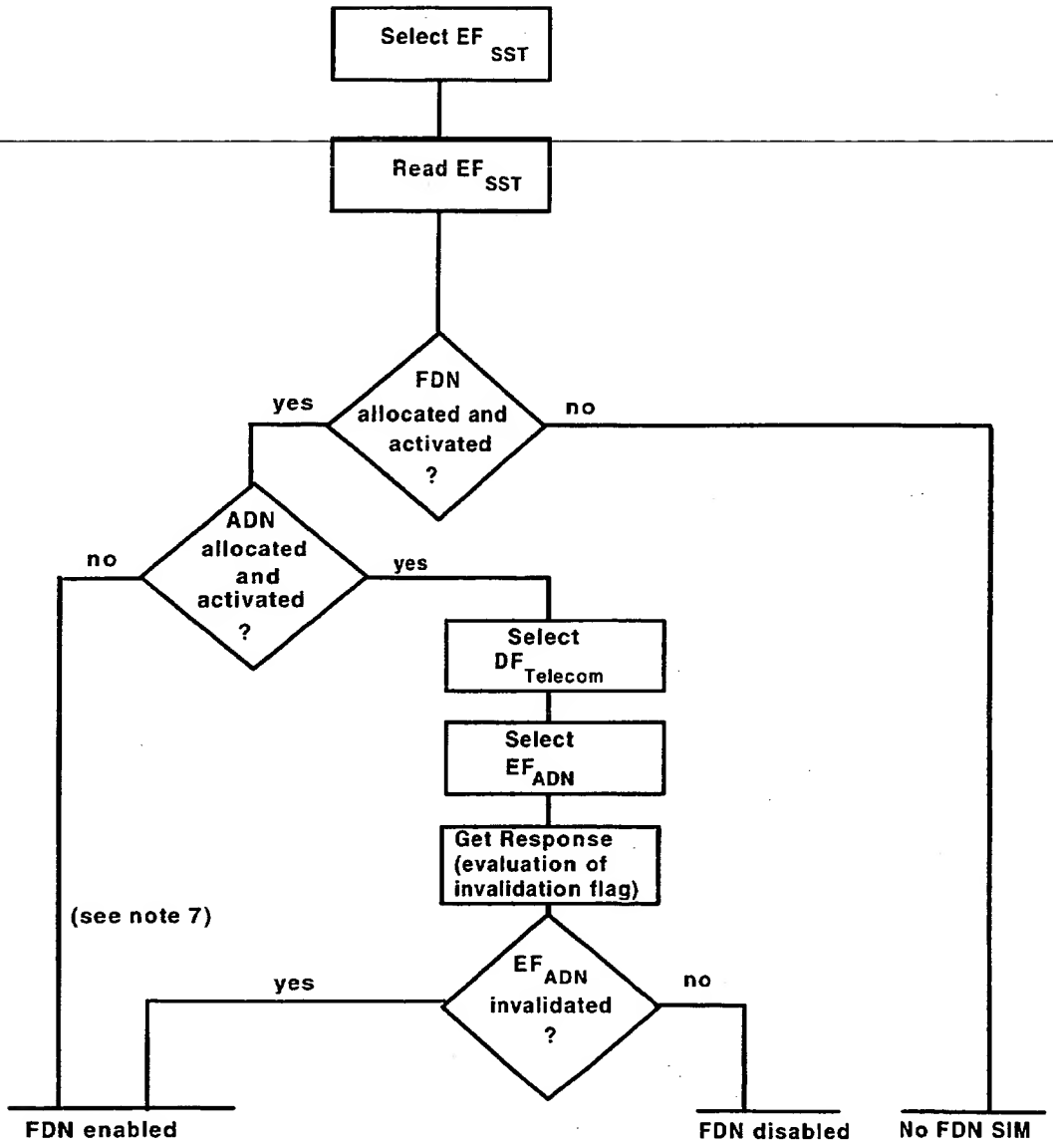
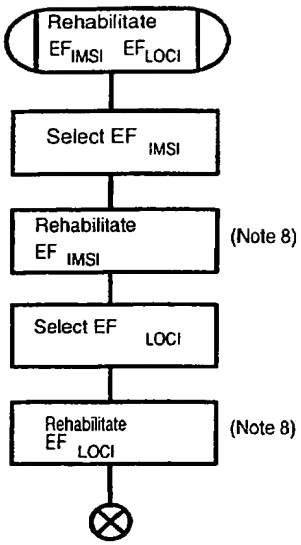


Figure C.3: BDN capability request (see 11.5.1)



NOTE 7: In this case FDN is enabled without the possibility of disabling.

Figure C.4: FDN capability request (see 11.5.1)



NOTE 8: If BDN is enabled in the SIM, and if the Profile download procedure has not indicated that the ME supports Call Control, the EF is not rehabilitated by the SIM.

Figure C.5: Procedure to rehabilitate GSM files

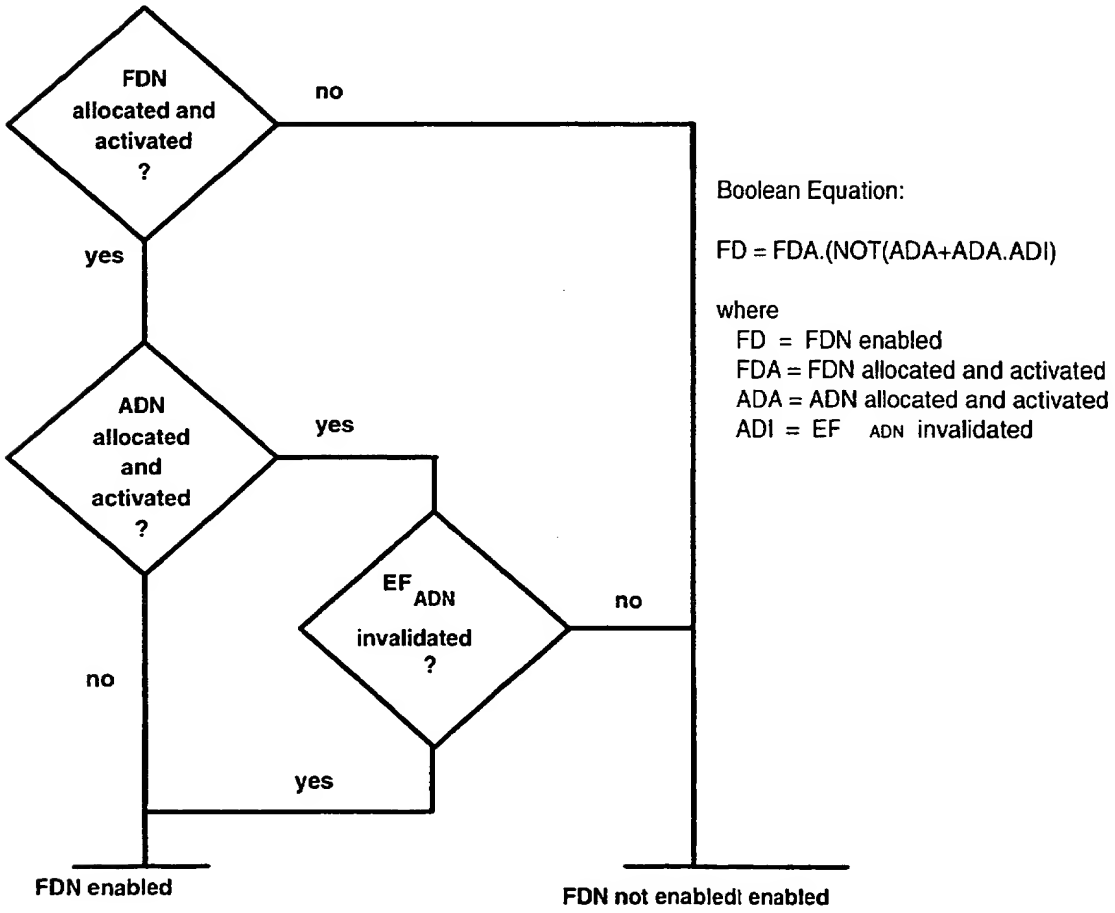


Figure C.6: Coding for state of FDN

Annex D (informative): Suggested contents of the EFs at pre-personalization

If EFs have an unassigned value, it may not be clear from the main text what this value should be. This annex suggests values in these cases.

File Identification	Description	Value
'2F E2'	ICC identification	operator dependant (see 10.1.1)
'2F 05'	Extended Language preference	'FF...FF'
'6F 05'	Language preference	'FF'
'6F 07'	IMSI	operator dependant (see 10.3.2)
'6F 20'	Ciphering key Kc	'FF...FF07'
'6F 30'	PLMN selector	'FF...FF'
'6F 31'	HPLMN search period	'FF'
'6F 37'	ACM maximum value	'000000' (see note 1)
'6F 38'	SIM service table	operator dependant (see 10.3.7)
'6F 39'	Accumulated call meter	'000000'
'6F 3E'	Group identifier level 1	operator dependant
'6F 3F'	Group identifier level 2	operator dependant
'6F 41'	PUCT	'FFFFFF0000'
'6F 45'	CBMI	'FF...FF'
'6F 46'	Service provider name	'FF...FF'
'6F 48'	CBMID	'FF...FF'
'6F 49'	Service Dialling Numbers	'FF...FF'
'6F 74'	BCCH	'FF...FF'
'6F 78'	Access control class	operator dependant (see 10.1.12)
'6F 7B'	Forbidden PLMNs	'FF...FF'
'6F 7E	Location information	'FFFFFFFF xxFxxx 0000 FF 01' (see note 2)
'6F AD'	Administrative data	operator dependant (see 10.3.15)
'6F AE'	Phase identification	see 10.3.16
'6F 3A'	Abbreviated dialling numbers	'FF...FF'
'6F 3B'	Fixed dialling numbers	'FF...FF'
'6F 3C'	Short messages	'00FF...FF'
'6F 3D'	Capability configuration parameters	'FF...FF'
'6F 40'	MSISDN storage	'FF...FF'
'6F 42'	SMS parameters	'FF...FF'
'6F 43'	SMS status	'FF...FF'
'6F 44'	Last number dialled	'FF...FF'
'6F 47'	Short message status reports	'00FF...FF'
'6F 4A'	Extension 1	'FF...FF'
'6F 4B'	Extension 2	'FF...FF'
'6F 4C'	Extension 3	'FF...FF'
'6F 4D'	Barred dialling numbers	'FF...FF'
'6F 4E'	Extension 4	'FF...FF'
'6F 51'	Network's indication of alerting	'FF...FF'
'6F 52	GPRS Ciphering key KcGPRS	'FF...FF07'
'6F 53	GPRS Location Information	'FFFFFFFF FFFFFF xxFxxx 0000 FF 01'

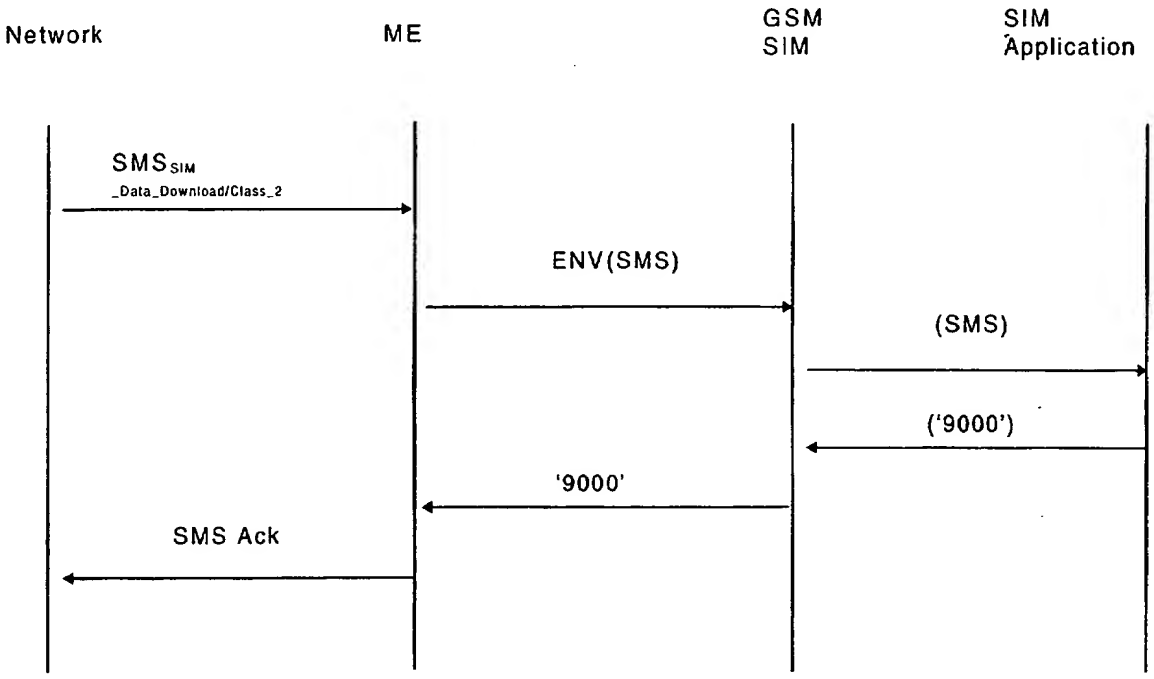
NOTE 1: The value '000000' means that ACMmax is not valid, i.e. there is no restriction on the ACM. When assigning a value to ACMmax, care should be taken not to use values too close to the maximum possible value 'FFFFFF', because the INCREASE command does not update EF_{ACM} if the units to be added would exceed 'FFFFFF'. This could affect the call termination procedure of the Advice of Charge function.

NOTE 2: xxFxxx stands for any valid MCC and MNC, coded according to GSM 04.08 [15].

Annex E (informative): SIM application Toolkit protocol diagrams.

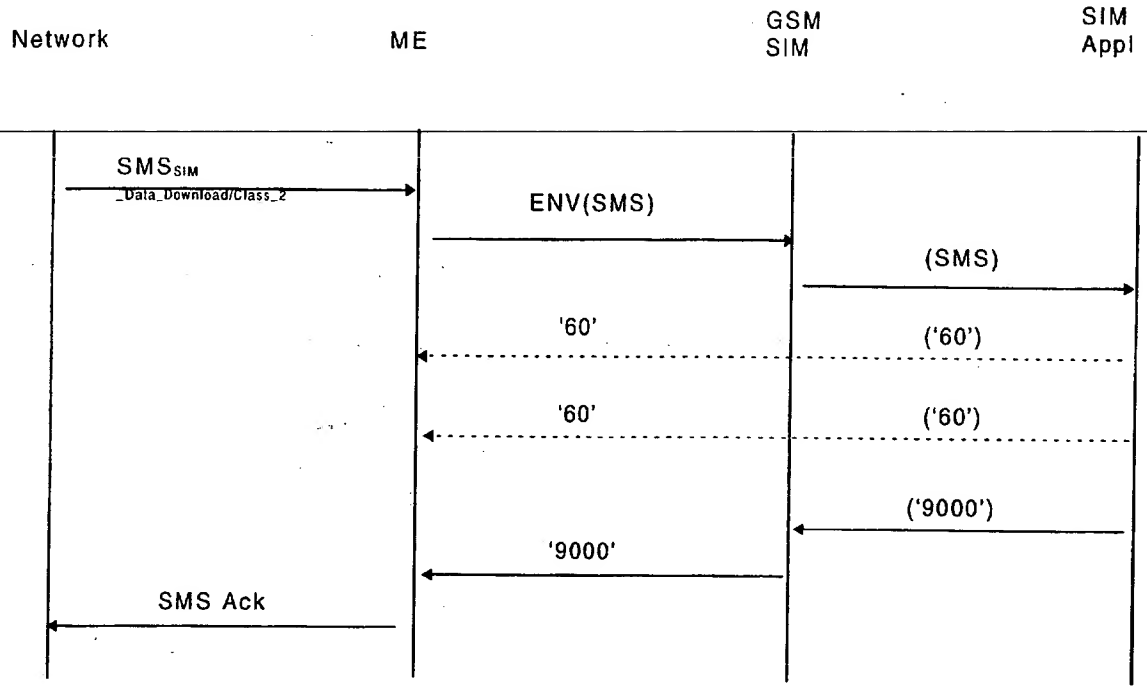
The diagrams in this annex are intended to illustrate the data protocols of the SIM toolkit application in various situations. The SIM application is shown as initiated by SMS Data Download messages. Other possibilities exist (as defined in GSM 11.14) such as data entry from a menu selection.

Case 1: Simple



This shows the simple case where an SMS for SIM updating is received from the network, passed to the SIM by the ME and processed immediately by the SIM application. This requires no ME action except to acknowledge the SMS.

Case 2: Simple with short delay



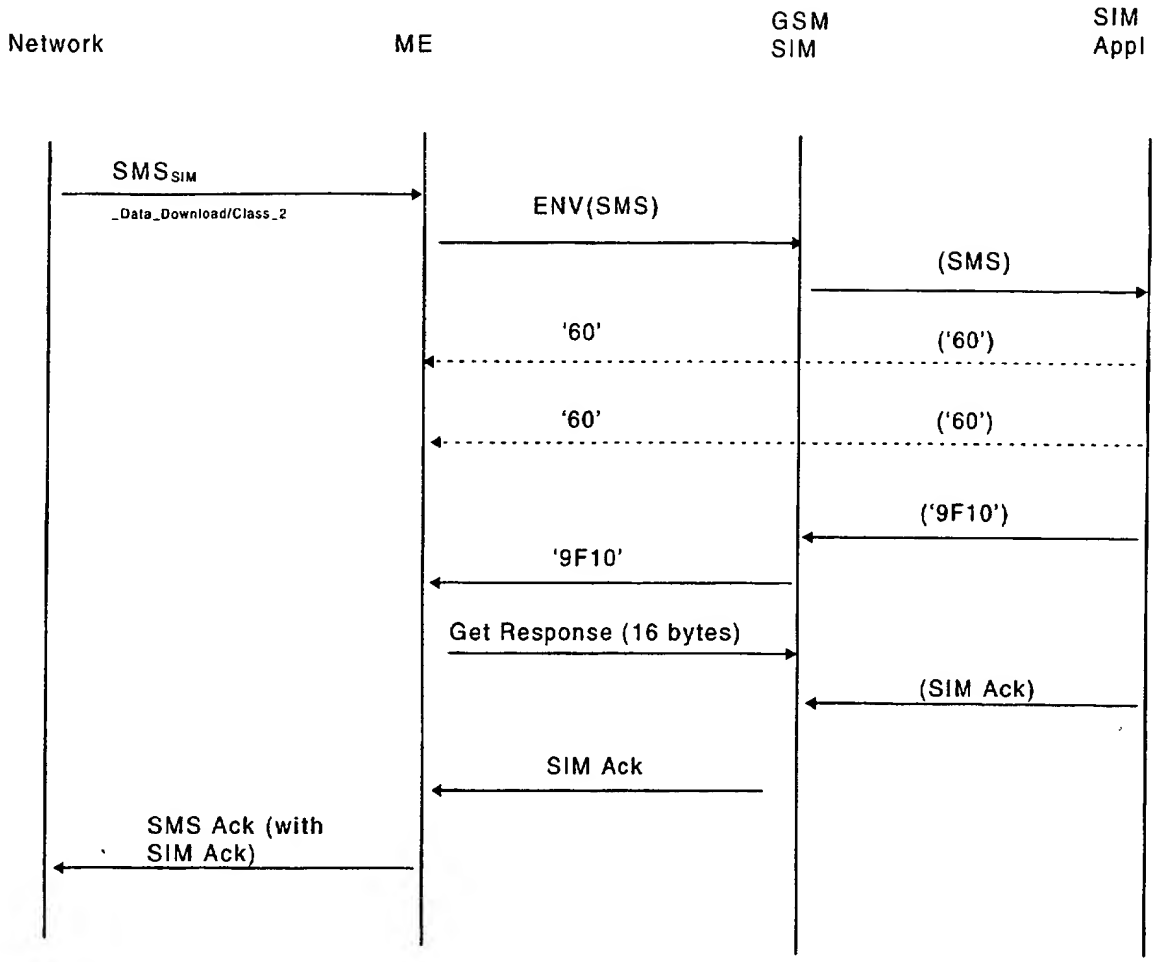
This shows the simple case where an SMS for SIM updating is received from the network, passed to the SIM by the ME and which requires some time to process by the SIM application. The processing time is "not long" and is obtained by the SIM application sending "null procedure bytes" to the ME. Each byte has the effect of restarting the work waiting time so that the ME does not abort the transaction before the SIM application has finished processing the command(s) sent in the SMS.

Guidelines on timings:

1. The SMS Ack must be sent back before the network times out and sends the SMS again.

2. Use of null procedure bytes must not be excessive as during this time the ME is unable to issue normal GSM commands to the SIM.

Case 3: Simple with short delay and SIM Acknowledgement

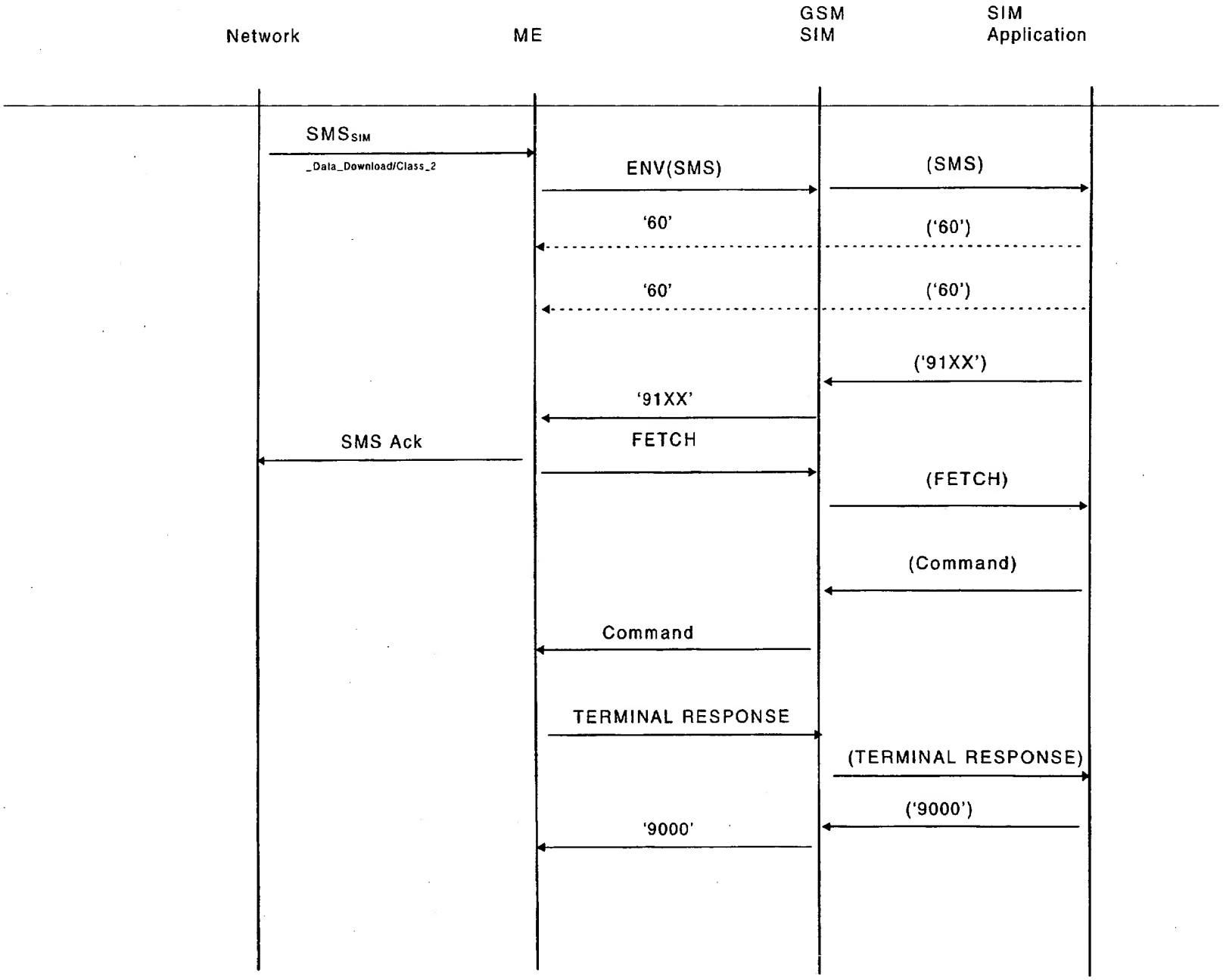


This shows the same case as previously where an SMS for SIM updating is received from the network, passed to the SIM by the ME and which requires some time to process by the SIM application. However in this case the SIM application has SIM acknowledgement data to include in the SMS acknowledgement being returned to the network by the ME.

Guideline on timings:

The SMS Ack must be sent back before the network times out and sends the SMS again.

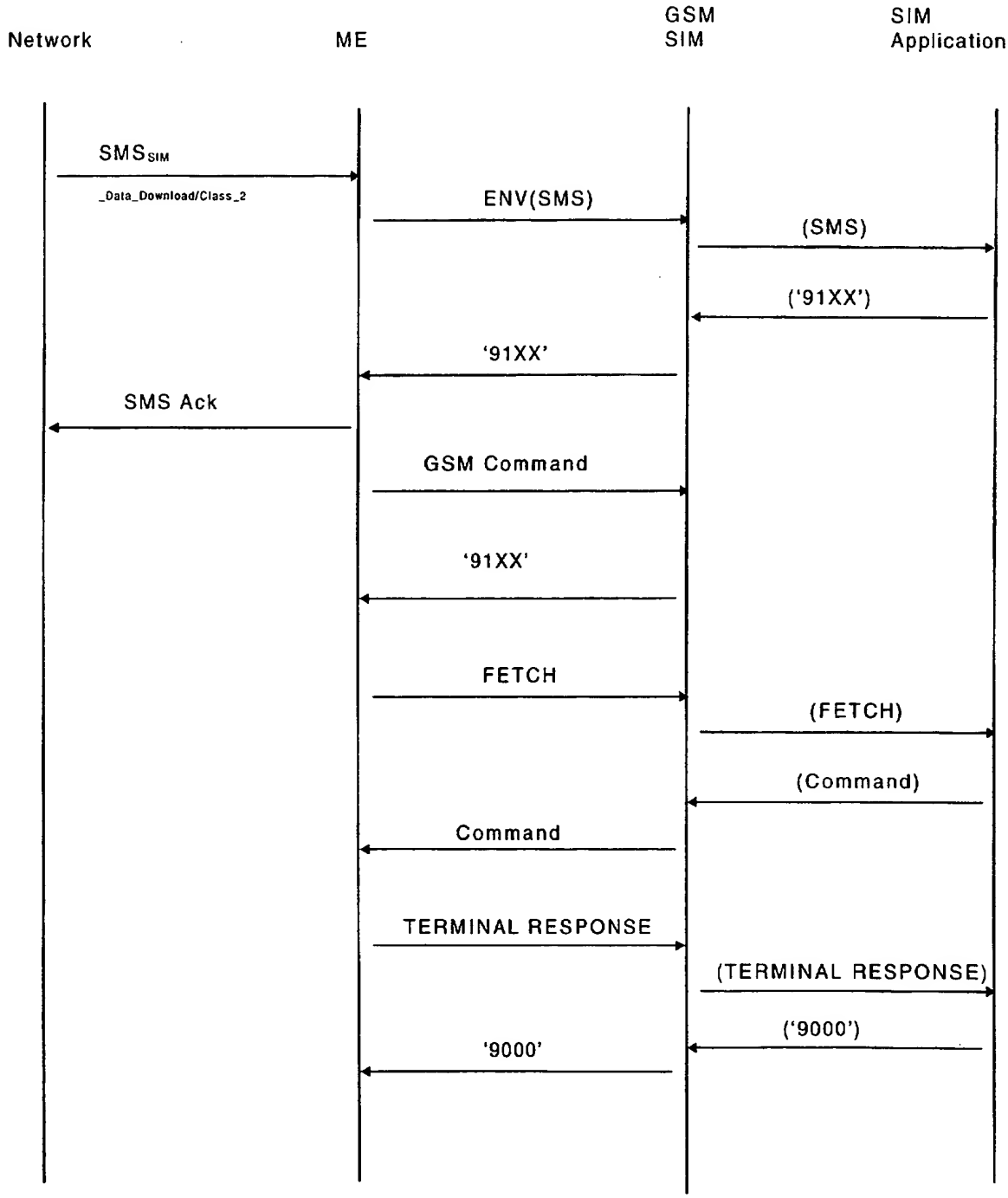
Case 4: A Toolkit command generated by the SIM application as a result of an SMS from the network



This shows the case where an SMS for SIM updating is received from the network, passed to the SIM by the ME and processed by the SIM application which then generates a command for action by the ME (e.g. PLAYTONE).

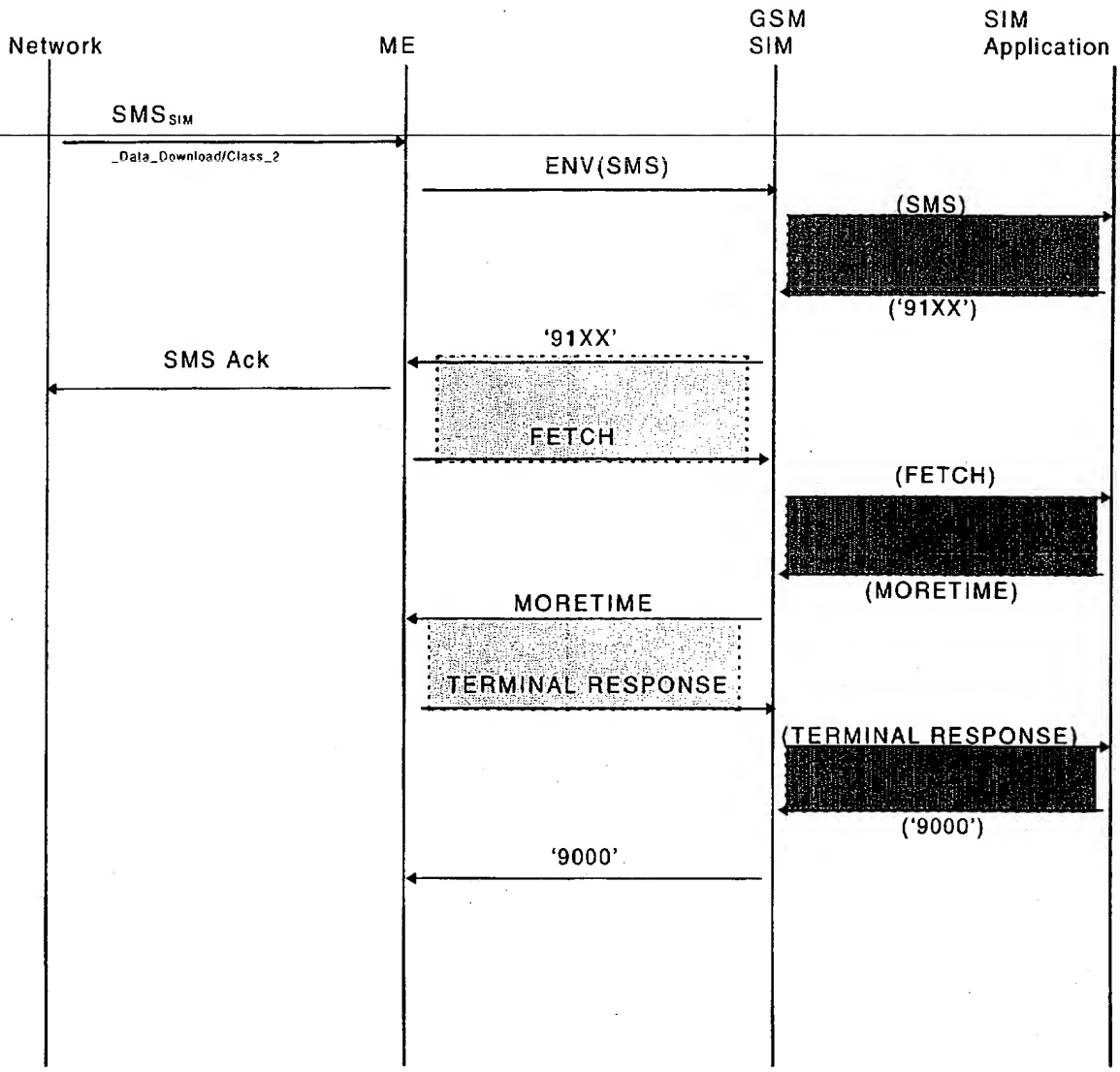
NOTE: If a positive acknowledgement to the network of completion of execution of the instructions given in the SMS message is required then the SIM application can issue a command to the ME to send a MO SMS.

Case 5: A normal GSM command requires processing before the ME can respond to the 91XX from the SIM



This shows the case where an SMS for SIM updating is received from the network, passed to the SIM by the ME and processed by the SIM application which then generates a command for action by the ME (e.g. PLAYTONE). However a normal GSM command requires processing before the ME can FETCH the command which the SIM is waiting to give it. The response to the normal GSM command is '91XX' in this case to remind the ME of the outstanding SIM application command request.

Case 6: MORE TIME Command

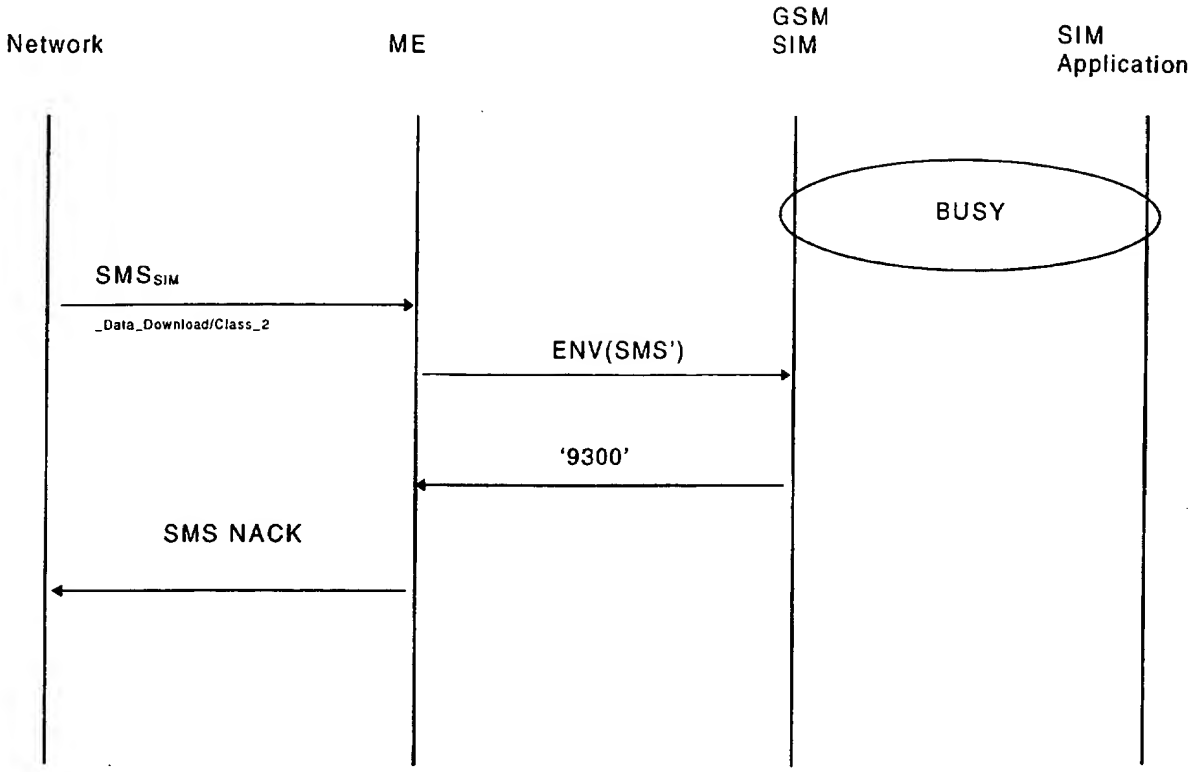


This shows the case where an SMS for SIM updating is received from the network, passed to the SIM by the ME and requires a considerable period of time to be processed by the SIM application. In this case the use of null procedure bytes only is inappropriate as the ME must be given the opportunity to process normal GSM commands. The opportunities gained by the SIM application for processing, and the opportunities for normal GSM commands are shown in the diagram above. The sequence of 91XX, FETCH and MORETIME commands can be repeated if required.

Opportunities to process normal GSM commands are shown thus:

Opportunities for SIM application processing are shown thus:

Case 7: SIM Application Busy



While the SIM application is busy processing a SMS for the SIM application arrives from the network and is sent to the SIM by the ME in the usual manner. The SIM operating system recognizes that the SIM application is busy, and it sends a busy response ('9300') to the ME. The ME then sends negative acknowledgement to the network. The responsibility for a retry rests with the network.

Annex F (informative): Bibliography

1) EN 726-3 (1994): "Terminal Equipment (TE); Requirements for IC cards and terminals for telecommunication use Part 3: Application independent card requirements".

2) EN 726-4 (1994): "Terminal Equipment (TE); Requirements for IC cards and terminals for telecommunication use Part 4: Application independent card related terminal requirements".

3) ISO/IEC 7816-3/A2 (1994): "Identification cards - Integrated circuit(s) cards with contacts, Part 3: Electronic signals and transmission protocols": "Protocol type select".

Annex G (informative): Change history

This annex lists all change requests approved for the present document since the first phase2+ version was approved by ETSI SMG.

SMG#	SMG tdoc	SMG9 tdoc	VERS	CR	RV	PH	CAT	SUBJECT	Resulting Version
S16	709/95	154/95	4.15.0	A008		r96	1	SIM Speed Enhancement	5.0.0
S17	062/96	147/95	5.0.0	A006		r96	B	Service Dialling Numbers	5.1.0
	060/96	06/96		A009		r96	B	ASCI for VGCS and VBS	
	060/96	06/96		A010		r96	B	ASCI for eMLPP	
	059/96	204/95r		A013		r96	C	Interaction between FDNs and ADNs	
	061/96	05/96		A014		r96	D	Correction of baud rate for SIM Speed enhancement	
S18	263/96	57/96	5.1.0	A011	3	r96	B	SIM Application Toolkit protocol enhancements	5.2.0
	260/96	45/96		A016		r96	A	SIM presence detection clarification	
	261/96	54/96		A018		r96	A	Reponse codes and coding of SIM service table	
	262/96	55/96		A020		r96	A	Reference to International Standards	
S19	374/96	102/96	5.2.0	A012		r96	C	Contacting elements	5.3.0
	373/96	105/96		A023		r96	A	Clarification of clock stop timing	
	409/96	107/96		A024	1	r96	B	Emergency Call Codes (ECC)	
	374/96	108/96		A025		r96	C	Using ranges of CBMIs	
S20	580/96	206/96	5.3.0	A021		r96	B	Barred Dialling Numbers	5.4.0
	734/96	197/96		A026		r96	B	Addition of Cooperative Network List EF	
	734/96	197/96		A027		r96	B	Addition of ME Depersonalisation feature and EF	
	702/96	207/96		A031		r96	D	RFU bit taken into use in GSM 11.12	
s21	101/97	97/079	5.4.0	A032	2	r96	D	Ammendment to BDN diagrams in Annex B	5.5.0
	101/97	97/086		A033	1	r96	B	DFs for MSS/ PCS1900/other use	
	101/97	97/056		A034		r96	C	Reading of EFDCK during SIM initialisation	
	101/97	97/058		A036		r96	D	Administrative Access Conditions	
	101/97	97/059		A037		r96	B	Format of EFCNL to include fields for Corporate Personal. Code	
	101/97	97/089		A041		r96	B	Administrative Data field	
s22	356/97	183/97	5.5.0	A042		r97	B	Extended language preference	5.6.0
	356/97	163/97		A044	1	r96	A	Clarification of electrical/mechanical SIM/ME interface	
	356/97	179/97		A045		r96	D	Security procedures for 2nd level; DFs located under DF GSM	
	356/97	187/97		A047		r96	F	Number of bytes returned after a SELECT command	
	356/97	093/97		A048		r96	D	Serivce table and "radio interface"	
	356/97	109/97		A049		r96	F	Update Access condition of EFDCK (aligns 11.11 & 02.22)	
s23	788/97	97/249	5.6.0	A046	2	r97	B	Short Message Status Reports	5.7.0
	788/97	97/243		A050		r96	F	Addition of SDN and BDN in the description of EFCCP	
	788/97	97/259		A051	1	r97	C	SIM and ME behaviour when SIM is disabled and blocked	
	788/97	97/262		A053		r96	F	Response data following an ENVELOPE command	
	788/97	97/260		A054		r96	F	Coding of EFPhase	
	788/97	97/271		A055		r97	C	Changes to Dialling Number Files and extensions	
	788/97	97/261		A056		r97	B	Network's indication of alerting in the MS	
s24	97-0886	97/365	5.7.0	A052	2	r97	b	Introduction of UCS2	5.8.0
	97-0886	97/383		A057		r97	c	MO SMS control by SIM	
At SMG #25, it was decided to create a version 6.0.0 of every specification that contained at least one release '97 workitem									
s25	98-0157	98p052	5.8.0	A058	2	R97	B	Addition of EFs for GPRS	6.0.0
	98-0157	98p108		A059		R97	F	Clarification regarding EFCCP records	
	98-0157	98p094		A061	1	r96	A	Clarification of removal of the SIM	
s26	98-0398	98p240	6.0.0	A066		R97	F	RP-ACK RP-ERROR for SIM data download error.	6.1.0
	98-0398	98p263		A069		R97	D	Allocation of file ID for IS-41	
s28	P-99-184	P-99-096	6.1.0	A079		R97	C	Addition of P-TIMSI signature value to EF LOCIGPRS	6.2.0
	P-99-188			A081		R97	D	Deletion of $(.....)$ release markers	

History

Document history		
V6.1.0	July 1998	Publication
V6.2.0	May 1999	Publication

ISBN 2-7437-3097-8
Dépôt légal : Mai 1999

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference	**FOR FURTHER ACTION** see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.	
International application No.	International filing date *(day/month/year)*	(Earliest) Priority Date *(day/month/year)*
PCT/IB 01/01493	31/05/2001	31/05/2000
Applicant		
SUAREZ BEJARANO, Fernando		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 2 sheets.

[X] It is also accompanied by a copy of each prior art document cited in this report.

1. **Basis of the report**

   a. With regard to the **language**, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

   [ ] the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

   b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing :

   [ ] contained in the international application in written form.

   [ ] filed together with the international application in computer readable form.

   [ ] furnished subsequently to this Authority in written form.

   [ ] furnished subsequently to this Authority in computer readble form.

   [ ] the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

   [ ] the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. [ ] **Certain claims were found unsearchable** (See Box I).

3. [ ] **Unity of invention is lacking** (see Box II).

4. With regard to the **title,**

   [X] the text is approved as submitted by the applicant.

   [ ] the text has been established by this Authority to read as follows:

5. With regard to the **abstract,**

   [X] the text is approved as submitted by the applicant.

   [ ] the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No. _____

   [ ] as suggested by the applicant.

   [ ] because the applicant failed to suggest a figure.

   [ ] because this figure better characterizes the invention.

   [X] None of the figures.

INTERNATIONAL SEARCH REPORT

International Application No
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Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
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C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0 525 708 A (INVENTA AG) 3 February 1993 (1993-02-03) claims 18-24 page 3, line 32 -page 4, line 13 page 5, line 40 - line 53 examples 19,21; table 1	3,4
L	GB 2 276 178 A (SANDOZ LTD) 21 September 1994 (1994-09-21) page 3, line 9 -page 6, line 10 page 11, line 8 - line 13 page 20, line 22 - line 27	1,3,4
A	EP 0 801 168 A (AIN ENGINEERING KK) 15 October 1997 (1997-10-15) claim 1 column 5, line 50 - line 57	3

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
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(54) **Zwischenschichten für Mehrschichtformkörper sowie Verfahren zu deren Auflösung.**

(57) Die Erfindung betrifft Haft-Trenn-Zwischenschichten für recyclierbaren Mehrschichtformkörpern aus Innen- und Aussenschicht sowie gegebenenfalls Mittelschicht(en), wobei die Haft-Trenn-Zwischenschichten aus mindestens einer Stärkeformmasse bestehen, in wässrigem Medium auflösbar sind und dadurch die Schichtmaterialien des Mehrschichtformkörpers abtrennbar und recyclierbar sind. Weiterhin betrifft die Erfindung ein Verfahren zum Auflösen von Haft-Trenn-Zwischenschichten mit gleichzeitiger Abtrennung der einzelnen Schichtmaterialien des Mehrschichtformkörpers, so dass diese Schichtmaterialien wiederverwertet werden können.

EP 0 525 708 A1

Die Erfindung betrifft den in den Patentansprüchen angegebenen Gegenstand. Insbesondere betrifft die Erfindung Haft-Trenn-Zwischenschichten für einen recyclierbaren Mehrschichtformkörper aus Innen- und Aussenschicht sowie gegebenenfalls Mittelschicht(en), wobei die Haft-Trenn-Zwischenschichten aus mindestens einer Stärkeformmasse bestehen, in wässrigem Medium auflösbar sind und dadurch die Schichtmaterialien des Mehrschichtformkörpers abtrennbar und recyclierbar sind. Weiterhin betrifft die Erfindung ein Verfahren zum Auflösen von Haft-Trenn-Zwischenschichten mit gleichzeitiger Abtrennung der einzelnen Schichtmaterialien des Mehrschichtformkörpers, so dass diese Schichtmaterialien wiederverwertet werden können.

Moderne Verpackungsmaterialien, insbesondere solche für den Einsatz bei Lebensmitteln und anderen verderblichen Produkten bestehen aus technisch hochentwickelten Mehrschichtformkörpern, insbesondere Mehrschichtfolien, welche auch als Verbund-, Laminat-, Sandwich- oder Koextrusionsfolien bezeichnet werden.

Monofolien, hergestellt aus nur einem Polymeren, weisen spezifische Eigenschaften, z.B. niedrige Gasdurchlässigkeiten, auf. Folien aus Polyvinylidenchlorid, Polyacrylnitril, Viylalkohol-Copolymeren, modifizierten Polyamiden und Polyestern sind für eine gute Sauerstoff-Barrierewirkung bekannt. Die Sperreigenschaften dieser Folien gegenüber Wasserdampf sind jedoch gering und zudem beeinflussen hohe Feuchtigkeitsgehalte der Folien auch die Sauerstoffsperrwirkung negativ. Folien, hergestellt aus Polyolefinen, weisen dagegen gute Sperreigenschaften gegenüber Wasserdampf auf. Für Verpackungen werden daher Folien mit entsprechenden Eigenschaften so kombiniert, dass Mehrschichtfolien mit speziellem Eigenschaftsprofil resultieren.

Da aber die verschiedenen Polymer-Schichten zum Teil eine schlechte Haftung zueinander haben, erfolgt der Verbund durch spezielle synthetische Haftvermittler. Die auf solche Weise hergestellten Mehrschichtfolien sind zwar optimal bezüglich ihrer Verpackungsfunktion, sind aber nach Gebrauch nicht mehr in ihre einzelnen Folienschichten zerlegbar und daher nicht wiederverwendbar.

Mehrschichtfolien sowie die daraus durch Verformung hergestellten Formkörper wie Blister, Behälter, Flaschen etc. belasten daher die Umwelt, weil es bis heute noch keine Möglichkeiten gibt, auf umweltfreundliche Weise die verschiedenen Folienschichten nach Gebrauch der Folie wieder zu trennen und wieder zu verwerten. Als Entsorgungsmöglichkeiten bestehen zurzeit neben der Deponierung nur noch die Verbrennung, welche aber auch nicht mehr toleriert wird, sobald im Verbund chlorhaltige Kunststoffe enthalten sind.

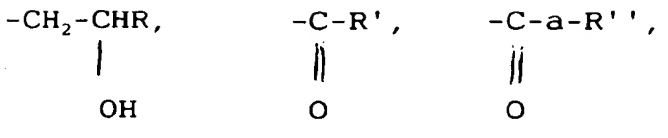
An Hochschulen laufen daher noch nicht veröffentlichte Pilotprojekte, um aus gemischten Kunststoffabfällen, worunter auch Mehrschichtformkörper fallen, durch Pyrolyse oder in speziellen Verbrennungsöfen die den Kunststoffen zugrunde liegenden verschiedenen Kohlenwasserstoffe und andere Bestandteile zurückzugewinnen. Andere Projekte versuchen, die Kunststoffe selektiv mit organischen Lösungsmitteln aus den Mehrschichtfolien oder anderen Kunststoffmischungen zu isolieren.

All diese Recyclingarten erfordern aber aufwendige Aufbereitungsschritte und damit teure Anlagen, wobei die polymeren Werkstoffe mindestens teilweise zerstört werden. Deshalb sind bis jetzt auch all diese Versuche im Pilotstadium stehen geblieben.

Es war daher Aufgabe der Erfindung Haft-Trenn-Zwischenschichten für Mehrschichtformkörper aus Innen- und Aussenschicht sowie gegebenenfalls Mittelschicht(en) zur Verfügung zu stellen sowie ein Verfahren zum Auflösen dieser Haft-Trenn-Zwischenschichten mit gleichzeitiger Abtrennung der einzelnen Schichtmaterialien des Mehrschichtformkörpers, damit eine Wiederverwertung der verschiedenen Schichtmaterialien möglich ist.

Diese Aufgabe wird gelöst durch die Ansprüche 1 und 18. Die Unteransprüche beschreiben vorteilhafte Weiterbildungen der Erfindung.

Erfindungsgemässe Haft-Trenn-Zwischenschicht(en) besteht bzw. bestehen aus mindestens einer Stärkeformmasse, die mindestens eine nicht-derivatisierte Stärke und/oder derivatisierte Stärke enthält, welche einen Amylosegehalt von 0 bis 100 Gew.-%, bevorzugt 50 - 100 Gew.-% und besonders bevorzugt 70 bis 100 Gew.-% besitzt. Bevorzugterweise enthält die Stärkeformmasse Additive ausgewählt aus der Gruppe der Weichmacher, Harnstoff, Harnstoffderivate, Emulgatoren mit einem Hydrophil-Lipophil-Balance-Wert von 0 bis 20, wie z.B. Stearate, Polyoxyethylen (20)-Sorbitanmonolaurat oder Polyoxyethylen (20)-Sorbitanmonopalmitat, Gleit- und Trennmittel. Die derivatisierte Stärke besitzt einen Substitutionsgrad von bevorzugt 0,03 bis 0,3 und enthält in einer speziellen Ausführungsform Substituenten aus der Gruppe



worin R ein H-Atom oder ein Alkylrest mit 1 bis 18 C-Atomen, R' ein Alkylrest mit 1 bis 18 C-Atomen, R'' eine OH-, OR- oder eine Polyethergruppe und a ein Methylen-, Ethylen- oder Isopropylenrest ist.

Eine andere Ausführungsform erfindungsgemässer Haft-Trenn-Zwischenschicht(en) enthält eine Stärkeformmasse, welche eine Stärke-Polymer-Mischung aus mindestens einer nicht und/oder derivatisierten Stärke und mindestens einem ausgewählten Polymeren mit einem Schmelz- oder Erweichungspunkt von 50 bis 200 °C, bevorzugt 60 bis 150 °C, ist. Der Anteil des(r) Polymeren, welche(s) bevorzugt aus der Gruppe der Polyester, Copolyester, Polyamide, Copolyamide, Polyolefine, Copolyolefine, Polyvinylalkohol, Ethylenoxidcopolymere, Propylenoxidcopolymere und Vinylalkoholcopolymere ausgewählt wird (werden), beträgt hierbei, bezogen auf die Gesamtmischung, 1 bis 90 Gew.-Teile, bevorzugt bis 60 Gew.-Teile.

Die Innen-, Aussen- und gegebenenfalls Mittelschicht(en) des recyclierbaren Mehrschichtformkörpers bestehen aus Polymeren, bevorzugt ausgewählt aus der Gruppe der Polyolefine und deren substituierten Derivate, Copolyolefine und deren substituierten Derivate, Polyester, Copolyester, Polyamide, Copolyamide, Polyvinylchlorid, Polyvinylidenchlorid, Polystyrole, Polycarbonate, Polyacrylnitril, Polysulfone, Polyacetate und Celluloseacetate, und/oder Metall, bevorzugt Aluminium, und/oder Metalloxid, bevorzugt ein Oxid des Siliziums, und/oder Karton und/oder siliziumorganische Verbindungen, bevorzugt Polysiloxane. Vorteilhafterweise werden die Metall- bzw. Metalloxidschichten hierbei mit entsprechenden Metallbedampfungsverfahren aufgebracht.

Von besonderem Vorteil ist, dass die erfindungsgemässe Haft-Trenn-Zwischenschichten selbst gute Barriere-Eigenschaften gegenüber Sauerstoff und Kohlendioxid besitzt.

Erfindungsgemässe Haft-Trenn-Zwischenschichten sind in recyclierbaren Mehrschichtformkörpern enthalten, welche als Folien, z.B. in Form von Blas- oder Flachfolien oder verformt zu Blisterfolien, oder als Hohlkörper, wie z.B. Flaschen, ausgebildet sein können und als Behälter und/oder Verpackungsmaterial im Lebensmittel-, Nonfood-, Medizinal-, Kosmetik- und Agrochemikalienbereich eingesetzt werden. Dem Fachmann werden noch weitere Einsatzmöglichkeiten für recyclierbaren Mehrschichtformkörpern mit erfindungsgemässen Haft-Trenn-Zwischenschichten in den Sinn kommen.

Erfindungsgemässes Verfahren zum Auflösen von Haft-Trenn-Zwischenschichten eines recyclierbaren Mehrschichtformkörpers mit gleichzeitiger Abtrennung der einzelnen Schichtmaterialien des Mehrschichtformkörpers aus Innen- und Aussenschicht sowie gegebenenfalls Mittelschicht(en) umfasst die folgenden Schritte: In einem ersten Schritt wird der Mehrschichtformkörper zu kleine Stücke oder Schnitzel zerkleinert, z.B. in einer Schneidemühle. In einem zweiten Schritt werden diese Schnitzel oder kleine Stücke in wässrigem Medium aufgeschlämmt und gegebenenfalls eine Zeit lang darin eingeweicht. In einem weiteren Schritt wird diese Aufschlämmung gegebenenfalls einer Enzymbehandlung unterworfen, bevor die Aufschlämmung mindestens einmal intensiv mechanisch behandelt wird, gegebenenfalls unter Erwärmung des wässrigen Mediums auf bevorzugt ca. 60 bis 80 °C. Diese mechanische Behandlung, welche bevorzugt ein energieintensives Rühren, insbesondere in Pulpern oder Fiberizern, umfasst und 15 bis 60 Minuten, bevorzugt 15 bis 45 Minuten, besonders bevorzugt 20 bis 30 Minuten dauert, kann mit Frischwasser wiederholt werden.

Der pH-Wert der eingesetzten wässrigen Phase ist im Bereich von ca. 3 bis 12 gemäss der Löslichkeit der unterschiedlichen Stärkeformmassen variierbar. Wird jedoch vorgängig zur mechanischen Behandlung noch eine Enzymvorbehandlung durchgeführt, so muss der pH-Wert entsprechend dem optimalen pH-Wert der Enzymaktivität (pH 5 bis 9) angepasst werden.

Solche Enzymvorbehandlungen können vorteilhaft in den Prozess nach der Zerkleinerungsstufe eingefügt werden, wenn die Haft-Trenn-Zwischenschicht(en) aus einer Stärke-Polymer-Mischung besteht bzw. bestehen. Geeignete Enzyme hierzu sind z.B. die Bactosol Typen der Fa. Sandoz.

Eine Erhöhung der Löslichkeit von Haft-Trenn-Zwischenschichten kann durch Zusätze von Netz- und Antischaummitteln zur wässrigen Phase erreicht werden.

Die Schnitzelgrösse der zerkleinerten Mehrschichtformkörper wirkt sich ebenfalls auf die Geschwindigkeit des Auflösevorgangs aus. Je kleiner die eingesetzten Schnitzel sind, desto kürzer sind z.B. die notwendigen Behandlungszeiten in den Rühreinrichtungen. In der Praxis haben sich Schnitzel in einer Grössenordnung von 1-20 mm, je nach Typ der eingesetzten Stärkeformmasse, bewährt. Nachdem sich die Haft-Trenn-Zwischenschicht(en) im wässrigen Medium aufgelöst hat bzw. haben, liegt eine wässrige Aufschlämmung aus gelöster Stärkeformmasse und nicht gelöster(n), nun aufgetrennt nebeneinander

vorliegenden Innen-, Aussen- und Mittelschichtmonofolien vor, welche in einen oder mehreren Sedimentiertank(s) überführt wird. Dort sammeln sich die einzelnen Monofolienschnitzel gemäss ihrer Dichte an der Wasseroberfläche , verteilen sich innerhalb des Wassers oder sinken auf den Boden ab. Dadurch können sie voneinander abgetrennt werden. Es ist auch möglich, die spezifisch leichteren von den spezifisch schwereren Schnitzel in kontinuierlichen Verfahren in Abtrennkammern zu separieren. Neben dem Schwimm-Sink-System kann die Abtrennung aber auch mittels eines Hydrozyklons erfolgen. Ein Zentrifugalfeld trennt die Polymerschnitzel, indem z.B. ein innerer, aufwärts gerichteter Wasserwirbel die spezifisch leichtere Fraktion ausbringt. Ein abwärts gerichteter Aussenwirbel separiert die spezifisch schwerere Fraktion.

Nach ihrer Trocknung können die separierten Materialschnitzel wieder verwertet werden, z.B. durch Aufschmelzen und Granulieren des Polymeren. Die Schichtmaterialien der Mehrschichtformkörper stehen dann also als Rohstoff wieder zur Verfügung. Das stärkehaltige Abwasser ist dagegen biologisch abbaubar und lässt sich über eine Kläranlage problemlos entsorgen.

Die folgenden Beispiele erläutern die Erfindung, ohne sie darauf zu beschränken.

Es wurden folgende Markenprodukte verwendet:

- LDPE 150 ist ein Low-Density-Polyethylen der Fa. DOW CHEMICAL mit einem Schmelzpunkt von ca. 100 °C
- Novolen 1300 ist ein Polypropylen der Fa. BASF mit einem Schmelzpunkt von ca. 160 °C
- Grilon CR 9 ist ein Copolyamid auf Basis der Monomeren von PA 6 und PA 12 der Fa. EMS-CHEMIE mit einem Schmelzpunkt von ca. 200 °C
- Grilon XE 3222 ist ein Copolyamid auf Basis der Monomeren von Polyamid 6 und Polyamid 6.9 der Fa. EMS-CHEMIE mit einem Schmelzpunkt von ca. 202 °C
- Surlyn 1652 ist ein Ionomer der Fa. Du Pont mit einem Schmelzpunkt von ca. 80 - 95 °C
- Grilamid L 25 ist ein Polyamid 12 der Fa. EMS-CHEMIE mit einem Schmelzpunkt von ca. 178 °C
- Eval EP-F101 ist ein Ethylenvinylalkoholpolymer der Fa. Kuraray (Japan) mit einem Schmelzpunkt von ca. 164 - 189 °C
- Lexan 141 ist ein Polycarbonat der Fa. GENERAL ELECTRIC mit einer Glastemperatur von ca. 150 °C
- UBE Nylon 5033B ist ein Copolyamid auf Basis der Monomeren von Polyamid 6 und Polyamid 6.6 der UBE (Japan) mit einem Schmelzpunkt von ca. 200 °C
- Kodapak PET 7352 ist ein Polyethylenterepthalat der Fa. EASTMAN CHEMICAL mit einem Schmelzpunkt von ca. 250 - 265 °C
- Givory G 21 ist ein amorphes Copolyamid auf Basis von Hexamethylendiamin, Terephthal- und Isophthalsäure der Fa. EMS-CHEMIE mit einer Glastemperatur von ca. 125 °C
- Dowlex 2476 ist ein Linear Low Density Polyethylen der Fa. DOW CHEMICAL, mit einem Schmelzpunkt von ca. 118 - 125 °C
- Grilon F 40 ist ein Polyamid 6 der Fa. EMS-CHEMIE mit einem Schmelzpunkt von ca. 220 °C
- Grilon CF 62 BSE ist ein Copolyamid auf Basis der Monomeren von Polyamid 6 und Polyamid 6.9 der Fa. EMS-CHEMIE mit einem Schmelzpunkt von ca. 134 °C
- Grilon CF 6S ist ein Copolyamid auf Basis der Monomeren von Polyamid 6 und Polyamid 12 der Fa. EMS-CHEMIE mit einem Schmelzpunkt von ca. 130 °C
- Grilon A 28 NZ ist ein schlagzähmodifiziertes Polyamid 6 der Fa. EMS-CHEMIE mit einem Schmelzpunkt von ca. 220 °C
- Bactosol MTN ist ein Produkt der Fa. SANDOZ und enthält Enzym-Stämme auf Basis von stabilisierten bakteriellen Amylosen in gepuffertem Medium
- Grilon XE 3294 ist ein Polyamid 6 der Fa. EMS-CHEMIE mit einem Schmelzpunkt von ca. 220 °C
- Lupolen 4730 ist ein High Density Polyethylen der Fa. BASF mit einem Schmelzpunkt von ca. 131 °C
- Grilon CF 62 BS ist ein Copolyamid auf Basis der Monomeren von Polyamid 6 und Polyamid 6.9 der Fa. EMS-CHEMIE mit einem Schmelzpunkt von ca. 138 °C
- Benvic IR 35 ist ein Polyvinylchlorid der Fa. Solvay mit einer Glastemperatur von ca. 80 °C

I. Herstellung der Stärkeformmassen für erfindungsgemässe Haft-Trenn-Zwischenschichten

A) Stärkeformmasse I:

Nach dem in der deutschen Patentanmeldung DE 4 117 628.6 beschriebenen Verfahren wurden aus 70 Gew.-Teilen Hydroxypropylmaisstärke mit einem Substitutionsgrad von 0,06 und einem Amylosegehalt von 50 Gew.-% sowie 15 Gew.-Teilen Glycerol, 12,8 Gew.-Teilen Sorbitol, 2 Gew.-Teilen Harnstoff und 0,2 Gew.-Teilen Magnesiumstearat eine Stärkeformmasse hergestellt.

B) Stärkeformmasse II:

70 Gew.-Teile der Stärkeformmasse I wurden mit 30 Gew.-Teilen Grilon CF 62 BSE gemischt und in die Dosierzone eines Doppelwellenextruders ZSK-30 (Fa. Werner & Pfleiderer) eindosiert und zu einer Stärkeformmasse verarbeitet.

II. Herstellung von recyclierbaren Mehrschichtformkörpern mit erfindungsgemässen Haft-Trenn-Zwischenschichten

Beispiele 1 bis 22: Mehrschichtfolien

Auf einer dem Stand der Technik entsprechenden Koextrusionsanlage für die Blas- und Flachfolienherstellung wurden Mehrschichtfolien mit koextrudierten Haft-Trenn-Zwischenschichten aus der Stärkeformmasse I oder II hergestellt.

In den Beispielen 14 und 15 wurde Karton koextrusionsbeschichtet.

In Beispiel 5 wurde eine durch Kalandrieren hergestellte PVC-Folie koextrusionsbeschichtet.

In den Beispielen 6, 7 und 14 erfolgte die Siliziumdioxidbzw. Aluminiumbeschichtung mittels einer Vakuummetallbedampfungsanlage.

Der Schichtaufbau, die Schichtmaterialien und die Schichtdicken der einzelnen Mehrschichtfolien sind Tabelle 1 zu entnehmen.

Beispiel 23: Hohlkörper

Aus einer dem Stand der Technik entsprechenden Extrusionsblasformanlage wurde eine Mehrschichtflasche hergestellt. Ihr Schichtaufbau, ihre Schichtmaterialien sowie ihre einzelnen Schichtdicken sind Tabelle 1 zu entnehmen.

III. Auflösung der Haft-Trenn-Zwischenschichten mit gleichzeitiger Abtrennung der einzelnen Schichtmaterialien von Mehrschichtformkörpern

Die Mehrschichtformkörper der Beispiele 1 bis 23 wurden mit einer Laborschneidmaschine (Typ Kondux) zu Schnitzel der Grösse von ca. 3 - 10 mm zerkleinert.

Die resultierenden Mehrschichtformkörperschnitzel der Beispiele Nr. 2, 5, 6 und 7 wurden einer enzymatischen Abbaureaktion mit Bactosol unterworfen:

Rührkessel Wasser Folienschnitzel	500 l 300 l 20 kg
Flottenzusätze	2 ml/l Sandopan DWF (Netzmittel) 3 ml/l Bactosol MTN
pH-Wert Temperatur Behandlungszeit	6 - 7 60 °C 60 Minuten

Je 5 kg Schnitzel der Beispiele Nr. 1, 3 und 4, 8 und 9 bis 23 sowie die enzymvorbehandelten Schnitzel der Beispiele 2, 5, 6 und 7 wurden nach der Enzymvorbehandlung in einen Laborpulper mit 200 l Frischwasser und einer Temperatur von 60 °C gegeben, aufgeschlämmt und während 15 Minuten gepulpt. Anschliessend wurde das stärkehaltige Wasser abgezogen und die Aufschlämmung mit frischem Wasser bei einer Temperatur von 60 °C nochmals während 5 Minuten im Pulper behandelt. Nach dem Umpumpen

in einen Sedimentiertank und anschliessendem Sedimentationsvorgang liessen sich die abgetrennten Monoschichtschnitzel gemäss ihrer Dichte und ihrer Schichtmaterialien, und damit nach Polymeren, separieren. Nach dem Trocknen wurden die abgetrennten Polymerschnitzel separat aufgeschmolzen und granuliert und standen dann als Rohstoff wieder zur Verfügung. Das stärkehaltige Abwasser ist biologisch abbaubar und wurde über die Kläranlage problemlos entsorgt.

Tabelle 1: Mehrschichtformkörper mit erfindungsgemässen Haft-Trenn-Zwischenschichten

Beispiel	Schicht	Schichtmaterial	Schichtdicke [µm]
Folien:			
1	Aussen- oder Innen-	LDPE 150	50
	Haft-Trenn-Zwischen-	Stärkeformmasse I	150
	Innen- oder Aussen-	LDPE 150	50
2	Aussen- oder Innen-	Novolen 1300	50
	Haft-Trenn-Zwischen-	Stärkeformmasse II	75
	Innen- oder Aussen-	Novolen 1300	50
3	Aussen- oder Innen-	Grilon CR 9	25
	Haft-Trenn-Zwischen-	Stärkeformmasse I	100
	Innen- oder Aussen-	LDPE 150	50
4	Aussen- oder Innen-	Grilon XE 3222	15
	Haft-Trenn-Zwischen-	Stärkeformmasse I	80
	Mittel-	Grilon XE 3222	15
	Haft-Trenn-Zwischen-	Stärkeformmasse I	80
	Innen- oder Aussen-	LDPE 150	50
5	Aussen-	Benvic IR 35	250
	Haft-Trenn-Zwischen-	Stärkeformmasse II	75
	Innen-	Surlyn 1652	50
6	Aussen- oder Innen-	Grilamid L 25	50
	Haft-Trenn-Zwischen-	Stärkeformmasse II	75
	Innen- oder Aussen-	Aluminium	0.8
7	Aussen- oder Innen-	Grilamid L 25	25
	Haft-Trenn-Zwischen-	Stärkeformmasse II	75
	Innen- oder Aussen-	SiO_2	0.6
8	Aussen- oder Innen-	Grilon XE 3222	25
	Haft-Trenn-Zwischen-	Stärkeformmasse I	80
	Innen- oder Aussen-	Surlyn 1652	50

9	Aussen- oder Innen-	LDPE 150	20
	Haft-Trenn-Zwischen-	Stärkeformmasse I	80
	Mittel-	Eval EP-F101	6
	Haft-Trenn-Zwischen-	Stärkeformmasse I	80
	Innen- oder Aussen-	LDPE 150	20
10	Aussen- oder Innen-	Lexan 141	20
	Haft-Trenn-Zwischen-	Stärkeformmasse I	60
	Mittel-	UBE Nylon 5033 B	20
	Haft-Trenn-Zwischen-	Stärkeformmasse I	60
	Innen- oder Aussen-	Lexan	20
11	Aussen- oder Innen-	Kodapak PET 7352	150
	Haft-Trenn-Zwischen-	Stärkeformmasse I	80
	Mittel-	Grivory G 21	50
	Haft-Trenn-Zwischen-	Stärkeformmasse I	80
	Innen- oder Aussen-	Kodapak PET 7352	100
12	Aussen- oder Innen-	Kodapak PET 7352	150
	Haft-Trenn-Zwischen-	Stärkeformmasse I	60
	Mittel-	Grivory G 21	50
	Haft-Trenn-Zwischen-	Stärkeformmasse I	60
	Innen- oder Aussen-	Dowlex 2476	100
13	Aussen-	Grilon F 40	25
	Haft-Trenn-Zwischen-	Stärkeformmasse I	100
	Innen-	LDPE 150	60
14	Aussen-	Karton	300g/m^2
	Haft-Trenn-Zwischen-	Stärkeformmasse I	60
	Mittel-	Aluminium	20
	Haft-Trenn-Zwischen-	Stärkeformmasse I	60
	Innen-	LDPE 150	60
15	Aussen-	Karton	300g/m^2
	Haft-Trenn-Zwischen-	Stärkeformmasse I	80
	Innen-	LDPE 150	40

16	Aussen- oder Innen- Haft-Trenn-Zwischen- Innen- oder Aussen-	Grilon CF 6 S Stärkeformmasse I Surlyn 1652	50 80 100
17	Aussen- oder Innen- Haft-Trenn-Zwischen- Innen- oder Aussen-	LDPE 150 Stärkeformmasse I Novolen 1300	50 100 50
18	Aussen- oder Innen- Haft-Trenn-Zwischen- Innen- oder Aussen-	Kodapak PET 7352 Stärkeformmasse I Grilon XE 3294	50 100 25
19	Aussen- oder Innen- Haft-Trenn-Zwischen- Mittel- Haft-Trenn-Zwischen- Mittel- Haft-Trenn-Zwischen- Innen- oder Aussen-	LDPE 150 Stärkeformmasse I Grilon CF 62 BS Stärkeformmasse I Eval EP-F101 Stärkeformmasse I Surlyn 1652	50 50 70 60 10 60 80
20	Aussen- oder Innen- Haft-Trenn-Zwischen- Innen- oder Aussen-	LDPE 150 Stärkeformmasse I Siliciumoxid *	20 50 0.3
21	Aussen- oder Innen- Haft-Trenn-Zwischen- Innen- oder Aussen-	LDPE 150 Stärkeformmasse II Aluminium **	20 40 0.4
22	Aussen- oder Innen- Haft-Trenn-Zwischen- Innen- oder Aussen-	LDPE 150 Stärkeformmasse I Siloxan ***	20 50 1
Hohl-körper:			
23	Aussen- oder Innen- Haft-Trenn-Zwischen- Innen- oder Aussen-	Lupolen 4730 Stärkeformmasse I Grilon A 28 NZ	1000 60 80

* Die SiO_x - Bedampfung erfolgte im Hochvakuum (4×10^{-4} Torr) in Sauerstoffatmosphäre durch Silizium mittels Lichtbogen während 30 Minuten

** Die Aluminiumbedampfung erfolgte im Hochvakuum (6×10^{-4} Torr) während 20 Minuten

*** Die Siloxanbeschichtung erfolgte durch Auftragen von Diethoxydimethylsilan mittels eines Rakels auf die Stärkeschicht und anschliessender Vernetzung mittels einer Elektronenstrahlkanone.

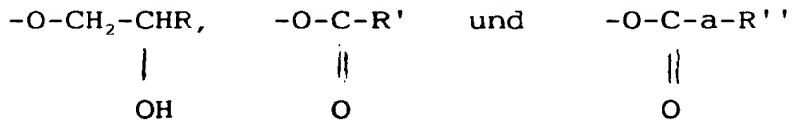
Patentansprüche

1. Haft-Trenn-Zwischenschicht(en) für einen recyclierbaren Mehrschichtformkörper aus Innen- und Aussenschicht sowie gegebenenfalls Mittelschicht(en), wobei die Haft-Trenn-Zwischenschicht(en) aus mindestens einer Stärkeformmasse besteht bzw. bestehen sowie in wässrigem Medium auflösbar ist bzw. sind und dadurch die Schichtmaterialien des Mehrschichtformkörpers abtrennbar und recyclierbar sind.

2. Haft-Trenn-Zwischenschicht(en) für einen recyclierbaren Mehrschichtformkörper gemäss Anspruch 1, wobei die Stärkeformmasse mindestens eine nicht-derivatisierte und/oder derivatisierte Stärke enthält.

3. Haft-Trenn-Zwischenschicht(en) für einen recyclierbaren Mehrschichtformkörper gemäss Anspruch 2, wobei die Stärke einen Amylosegehalt von 0 bis 100 Gew.-%, bevorzugt 50 bis 100 Gew.-%, besonders bevorzugt von 70 bis 100 Gew.-%, besitzt.

4. Haft-Trenn-Zwischenschicht(en) für einen recyclierbaren Mehrschichtformkörper gemäss den Ansprüchen 2 und 3, wobei in der derivatisierten Stärke die Hydroxygruppen durch Substituenten ausgewählt aus der Gruppe



ersetzt sind, wobei
R ein H-Atom oder ein Alkylrest mit 1 bis 18 C-Atomen,
R' ein Alkylrest mit 1 bis 18 C-Atomen,
R'' eine OH-, OR- oder Polyethergruppe und
a ein Methylen-, Ethylen oder Isopropylenrest ist.

5. Haft-Trenn-Zwischenschicht(en) für einen recyclierbaren Mehrschichtformkörper gemäss den Ansprüchen 2 bis 4, wobei die derivatisierte Stärke einen Substitutionsgrad von 0,03 bis 0,3 besitzt.

6. Haft-Trenn-Zwischenschicht(en) für einen recyclierbaren Mehrschichtformkörper gemäss den Ansprüchen 2 bis 5, wobei die Stärkeformmasse Additive ausgewählt aus der Gruppe der Weichmacher, Harnstoff, Harnstoffderivate, Emulgatoren, Gleitmittel und Trennmittel enthält.

7. Haft-Trenn-Zwischenschicht(en) für einen recyclierbaren Mehrschichtformkörper gemäss den Ansprüchen 2 bis 6, wobei die Stärkeformmasse eine Stärke-Polymer-Mischung aus mindestens einer nicht-

derivatisierten Stärke und/ oder derivatisierten Stärke und mindestens einem linearen Polymeren mit einem Schmelz- oder Erweichungspunkt von 50 bis 200 ° C, bevorzugt 60 bis 150 ° C, ist.

8. Haft-Trenn-Zwischenschicht(en) für einen recyclierbaren Mehrschichtformkörper gemäss Anspruch 7, wobei das lineare Polymere ausgewählt ist aus der Gruppe der Polyester, Copolyester, Polyamide, Copolyamide, Polyolefine, Copolyolefine, Polyvinylalkohole, Ethylenoxidpolymere, Propylenoxidpolymere und Vinylalkoholcopolymere.

9. Haft-Trenn-Zwischenschicht(en) für einen recyclierbaren Mehrschichtformkörper gemäss den Ansprüchen 7 und 8, wobei der Polymeranteil 1 bis 90 Gew.-Teile, bevorzugt bis 60 Gew.-Teile, bezogen auf die Gesamtmischung, beträgt.

10. Haft-Trenn-Zwischenschicht(en) für einen recyclierbaren Mehrschichtformkörper gemäss den Ansprüchen 1 bis 9, wobei die Innen- und Aussenschicht sowie die gegebenenfalls Mittelschicht(en) ausgewählt sind aus der Gruppe der Polymeren, der Metalle, der Metalloxide , der siliciumorganischen Verbindungen und Karton.

11. Haft-Trenn-Zwischenschicht(en) für einen recyclierbaren Mehrschichtformkörper gemäss Anspruch 10, wobei das Polymere ausgewählt ist aus der Gruppe der Polyolefine und deren Derivaten, der Copolyolefine und deren Derivaten, Polyester, Copolyester, Polyamide, Copolyamide, Polyvinylchloride, Polyvinylidenchloride, Polystyrole, Polycarbonate, Polyacrylnitrile, Polysulfone, Ionomere, Polyacetate und Celluloseacetate.

12. Haft-Trenn-Zwischenschicht(en) für einen recyclierbaren Mehrschichtformkörper gemäss Anspruch 10, wobei das Metall Aluminium ist.

13. Haft-Trenn-Zwischenschicht(en) für einen recyclierbaren Mehrschichtformkörper gemäss Anspruch 10, wobei das Metalloxid ein Oxid des Siliziums ist.

14. Haft-Trenn-Zwischenschicht(en) für einen recyclierbaren Mehrschichtformkörper gemäss Anspruch 10, wobei die siliziumorganische Verbindung Siloxan ist.

15. Haft-Trenn-Zwischenschicht(en) für einen recyclierbaren Mehrschichtformkörper gemäss den Ansprüchen 1 bis 14, wobei der Mehrschichtformkörper eine Mehrschichtfolie ist.

16. Haft-Trenn-Zwischenschicht(en) für einen recyclierbaren Mehrschichtformkörper gemäss den Ansprüchen 1 bis 14, wobei der Mehrschichtformkörper ein Hohlkörper ist.

17. Haft-Trenn-Zwischenschicht(en) für einen recyclierbaren Mehrschichtformkörper gemäss den Ansprüchen 1 bis 16, wobei der Mehrschichtformkörper als Behälter oder Verpackungsmittel, bevorzugt im Lebensmittel-, Nonfood-, Medizinal-, Kosmetik- und Agrochemikalienbereich eingesetzt wird.

18. Verfahren zum Auflösen von Haft-Trenn-Zwischenschichten eines recyclierbaren Mehrschichtformkörpers gemäss den Ansprüchen 1 bis 17 mit gleichzeitiger Abtrennung der einzelnen Schichtmaterialien des Mehrschichtformkörpers aus Innen- und Aussenschicht sowie gegebenenfalls Mittelschicht(en), in dem

a) der Mehrschichtformkörper zu kleinen Stücken oder Schnitzel zerkleinert wird
b) diese mindestens einmal in wässrigem Medium aufgeschlämmt und gegebenenfalls eingeweicht werden
c) diese Aufschlämmung gegebenenfalls einer Enzymbehandlung unterworfen wird
d) diese Aufschlämmung mindestens einmal intensiv mechanisch behandelt wird, gegebenenfalls unter Erwärmung des wässrigen Mediums, so dass dann in der Aufschlämmung kleine Stücke oder Schnitzel der Innen-, Aussen- oder Mittelschicht(en) aufgetrennt nebeneinander vorliegen
e) diese Aufschlämmung in mindestens einen Sedimentiertank überführt wird, in dem die kleinen Stücke oder Schnitzel sich entsprechend ihrer Materialdichte ansammeln und
f) diese abgetrennt werden

19. Verfahren gemäss Anspruch 18, wobei die Grösse der kleinen Stücke oder Schnitzel 1 bis 20 mm

beträgt.

20. Verfahren gemäss den Ansprüchen 18 und 19, wobei die mechanische Behandlung in Schritt d) ein energieintensives Rühren, bevorzugt in Pulpern oder Fiberizers, umfasst.

21. Verfahren gemäss den Ansprüchen 18 bis 20, wobei das wässrige Medium in Schritt d) auf 60 bis 80 °C erhitzt wird.

22. Verfahren gemäss den Ansprüchen 18 bis 21, wobei die mechanische Behandlung in Schritt d) 15 bis 60 Minuten, bevorzugt 15 bis 45 Minuten, besonders bevorzugt 20 bis 30 Minuten dauert.

23. Verfahren gemäss den Ansprüchen 18 bis 22, wobei das wässrige Aufschlämmmedium einen pH-Wert von 3 bis 12 besitzt.

24. Verfahren gemäss den Ansprüchen 18 bis 22, wobei das wässrige Aufschlämmmedium bei der Enzymvorbehandlung einen pH-Wert von 5 bis 9 besitzt.

Europäisches Patentamt

EUROPÄISCHER RECHERCHENBERICHT

Nummer der Anmeldung

EP 92 11 2825

EINSCHLÄGIGE DOKUMENTE

Kategorie	Kennzeichnung des Dokuments mit Angabe, soweit erforderlich, der maßgeblichen Teile	Betrifft Anspruch	KLASSIFIKATION DER ANMELDUNG (Int. Cl.5)
X	DATABASE WPIL Section Ch, Week 8351, Derwent Publications Ltd., London, GB; Class A32, AN 83-847253 & JP-A-58 193 254 (TOYO SEIKAN KAISHA) * Zusammenfassung * ---	1-3, 10-12, 15-17	B32B9/02 C08L3/02 C08J11/06
A	GB-A-1 456 629 (TOYO SODA MANUFACTURING CO. LTD.) * Ansprüche 1,4 * * Seite 2, Zeile 109 - Seite 2, Zeile 124 * ---	1	
A	US-A-4 543 364 (R.J. NANKEE ET AL.) * Anspruch 9 * ---	18	
P,X	WO-A-9 116 375 (TOMKA, Y.) * Ansprüche 1-9 * * Seite 3, Zeile 25 - Seite 4, Zeile 18 * -----	1,2,6-15	

RECHERCHIERTE SACHGEBIETE (Int. Cl.5)

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Der vorliegende Recherchenbericht wurde für alle Patentansprüche erstellt

Recherchenort	Abschlußdatum der Recherche	Prüfer
DEN HAAG	25 NOVEMBER 1992	HALLEMEESCH A.D

KATEGORIE DER GENANNTEN DOKUMENTE

X : von besonderer Bedeutung allein betrachtet
Y : von besonderer Bedeutung in Verbindung mit einer anderen Veröffentlichung derselben Kategorie
A : technologischer Hintergrund
O : nichtschriftliche Offenbarung
P : Zwischenliteratur

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(54) Treatment of textiles

(57) A single bath process for imparting both a stonewashed and overdyed appearance to denim textiles and articles employs a bath comprising a dye, a cellulase enzyme and optionally but preferably a salt, and/or an amylase, the salt being in an amount in excess of that normally expected to be useful at 88 - 94°C.

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Treatment of Textiles

The present invention relates to the treatment of dyed textiles, and more particularly to providing denim textiles which have an overdyed and stone washed appearance.

Dyed cellulosic textiles which are commonly known as "denim" are used in making a large variety of products, especially garments such as so-called "blue" jeans, skirts, jackets, shirts, as well as other products such as bags, and purses. Denim textiles (or simply "denim") are generally constructed of a warp yarn which is woven with a filling yarn. Generally, the warp yarn is dyed a color such as indigo, blue, black or other color while the filling yarn is generally an unbleached or white yarn. Denim textiles where both the warp yarn and the filling yarn are dyed are also known.

There are three processes which are commonly used to obtain fashionable and/or aesthetic finishes on denim. These are "stone-washing", "overdyeing" and a combination of these two to give the so-called "distressed look".

Stone-washing is achieved by washing the denim in the presence of an abrasive substance (typically pumice stone), by treating the denim in a bath comprising at least one cellulase enzyme under suitable conditions, or by a combination of these two treatments. Desizing can proceed or accompany the abrading process. Overdyeing involves the subjection of denim which has already been dyed, especially such denim comprising undyed fill yarn, to a dyeing process, usually with a direct dye, under

appropriate dyeing conditions.

The "distressed look" is obtained by stone-washing (enzyme and/or abrasive), followed by overdyeing. The resultant products are more flexible and attractive and desirable colouring effects can be achieved. However, the production of such a desirable result has hitherto required that there be employed a sequence of two steps, each with its own particular requirements, and this makes the commercial process relatively complicated and expensive.

It has now been found, surprisingly, that it is possible to achieve desirable appearance on denim by a process which involves a single bath and which, as a result, is easier to perform and costs less. The invention therefore provides a process for the treatment of denim textile, comprising treating the textile with a cellulase enzyme in the presence of a dye. The present invention further provides an aqueous textile treatment bath comprising at least one dye effective for the dyeing of cellulose-containing textiles or textile articles, preferably denim, and at least one cellulose-active enzyme effective for imparting a distressed or stonewashed effect to cellulose-containing textiles or textile articles, preferably denim. The process according to the invention may be incorporated into conventional denim textile treatment processes, particularly processes which are directed to treating denim textiles or goods to impart an overdyed and distressed (or stonewashed) appearance thereto.

The present invention also provides a textile treatment preparation comprising at least one dye effective for the dyeing of cellulose-containing textiles or textile articles, preferably denim, and at least one cellulose-active enzyme effective for imparting a distressed or stonewashed effect upon cellulose-containing textiles or textile articles, and optionally but preferably a salt.

The present invention further provides a process for the treatment of denim textiles by conducting a simultaneous amylase (starch-desizing) and cellulase treatment in the presence of a dye which eliminates the necessity for a prior separate desizing

step.

The present invention further provides a textile treatment preparation comprising at least one dye effective for the dyeing of cellulose comprising textiles or textile articles, preferably denim, and at least one cellulose-active enzyme effective for imparting a distressed or stonewashed effect to cellulose-containing textiles or textile articles, a starch-desizing amylase and optionally but preferably a salt.

Other features of the invention will become more apparent from the following detailed description.

Cellulose-active enzymes, also known to the art as "cellulases" which are useful in the practice of the present invention include those cellulose-active enzyme containing compositions and preparations which are well known to the textile industry. A wide variety of such compositions are available and are suitable in the practice of the present invention. These cellulose-active enzyme-containing compositions and preparations may contain a mixture of cellulases as produced from a natural source, such as a microorganism or alternatively they may contain one or more cellulose-degrading enzymes which have been produced by recombinant technology. Typically, the cellulose-active enzyme containing compositions will use endo-cellulases or mixtures thereof which comprise at least about 50% endo-cellulases and other cellulose degrading cellulases including exo-cellulases. Other cellulase enzymes which act on cellulose enzymatic degradation products may be present as well, for example cellobiohydrolase and/or cellobiase.

It is well known that cellulase enzymes exhibit their action optimally or only under certain conditions of pH and temperature, and are also subject to deactivation in the presence of various elements or substances. In general, cellulase enzymes exhibit activity in the pH range of 3.8-6.5 and in the temperature range of 35-65°C. For definition purposes herein, optimum activity is defined as a condition of pH and/or temperature which achieves at least 50% of the maximum activity. An optimal activity pH range will be the pH range over which the enzyme exhibits such optimum

activity independent of temperature. An optimal activity temperature range will be the temperature range over which the enzyme exhibits such optimum activity independent of pH. In carrying out the inventive process, the cellulase will be selected such that its general activity in terms of pH and temperature is found to provide satisfactory results with the particular dye selected for use. For the purpose of this invention, the cellulases exhibit their optimal activity in the pH range of 3.8-5.5 and in the temperature range of 55°-65°C.

The amount of cellulase enzyme employed will be largely dependent upon the desired length of the treatment, the treatment conditions and the ultimate effect sought. Expressed in units of cellulase activity, the amount of cellulase enzyme employed may vary over a wide range, such as from at little as 900 CMC units per pound of textile, up to about 6000 CMC units per pound of textile, or even more. Preferably amounts of from 1500 to 6000 CMC units per pound may generally be employed, and amounts of from about 2000 to about 3500 units per pound may be employed over the more typical treatment periods, for example 35-50 minutes to obtain good results with considerably reduced white streaking and good final product quality.

Generally, for most desired treatments, the amount of cellulase enzyme employed will be within the range which is conventionally used to abrade textiles under the pH, time and temperature conditions which are normally associated with the cellulase enzyme absent the dye. One typical set of treatment conditions includes the presence of cellulase enzyme in the range of about 2000-3000 CMC units per pound of textile, over a treatment period of 15-60 minutes. Suitable treatment temperature is a temperature range wherein the cellulase enzyme is sufficiently active to impart the stonewashed effect, which is recognized as being dependent upon the particular cellulase enzyme utilized. Conventionally, a temperature of between about 55°C and about 60°C is effective.

Amylase enzymes, also known to the art as "amylases" which are useful in the practice of the present invention include those amylase enzyme-containing

compositions and preparations which are well known to the textile industry. A wide variety of such compositions are known and are available and are considered suitable in the practice of the present invention. These compositions and preparations may contain a single amylase or may be a mixture with cellulases as produced from a natural source, such as a microorganism, or alternatively they may contain one or more cellulose-degrading enzymes which have been produced by recombinant technology.

As is known in the art, starch sizing agents include those which are both in the form of starch as well as those which are in the form of starch with further other starch-like sizing substances such as polyvinyl alcohols, polyvinylacrylates, and/or carboxymethylcellulose. Usually the latter form of such sizing agents comprise at least about 30% by weight starch, but more usually comprise at least about 50% by weight starch. The amylases employed in the practice of certain embodiments of the invention may be used in any amount but are desirably employed in at least a minimum amount effective to substantially degrade the starch portion of the sizing agent present on the textile being treated. By "substantially degrade" it is meant that at least about 80% by weight of the starch present in the starch sizing agent will be removed by the amylase, more desirably at least 90% is removed. Tests for determining the amount of added starch removed in a conventional desizing step are well known to the industry and may be readily used to determine the minimum effective amount of the amylase enzyme needed to substantially degrade the starch sizing agent.

As will be realized by the skilled practitioner, the effectiveness of the amylase is largely a function of the concentration and time at any given condition of operation such as pH and temperature. In carrying out the inventive process, it is desirable that the amylase and its amount be selected such that it will desirably exhibit sufficient activity at the conditions of the bath within which it is used such that the sizing agent is substantially degraded as described above. It is to be understood, however, that as the total contact time of the amylase and the textile material will be longer than would

be expected where the amylase is used essentially only in a desizing process step, it is to be expected that the total amount of amylase when used in conjunction with the cellulase and the dye in accordance with the invention may be less than the amount which would be required in a separate desizing process step. For example, with the use of a representative amylase enzyme treatment composition having a concentration and potency of the types well known to the industry, Bactosol® MTN (available form Sandoz Chemicals, Basel, Switzerland), an amount of at least 0.4 grams per liter will usually be employed. Although amounts as high as 4 grams per liter of treatment bath may be used (and even higher), it is generally preferred to use from about 0.5-2 grams per liter of bath, more preferably from 0.75-1.5 grams per liter.

The dyes which are useful include water soluble or water-dispersible dyes which are useful in dyeing cellulose, for example, direct dyes and fiber reactive dyes. Preferably the dyes are direct dyes. Useful to the invention are the direct dyes which are well known to the art and include those which are defined in the Colour Index, Volume 2, pp. 2005-2478 (The Society of Dyers and Colourists, London, 1971) the contents of which are herein incorporated by reference. Most of the direct dyes belong to the dis-, tris- and polyazo classes, while the minority of direct dyes are categorized in the monoazo, stilbene, oxazine, thiazine and phthalocyanine categories. Usually, the direct dyes are anionic in character relative to cellulose and are applied from an aqueous bath containing an electrolyte. Such an electrolyte is generally formed by the addition to the dye bath with at least an effective amount of a salt generally used in conjunction with a direct dye. Most frequently the salt is sodium chloride, sodium sulfate or sodium sulfate decahydrate (Glauber's salt).

In accordance with the inventive teaching there is provided a process for the treatment of denim textiles or articles containing denim textiles to simultaneously impart a stonewashed and overdyed appearance thereto. The process is advantageously carried out on dyed denim textiles as well as on articles containing or made from such dyed denim textiles. The denim textiles may be in unsewn condition

or sewn partially or in fully finished product condition. Denim textiles which are composed of less than 100% cellulose fibers, such as in the case of fiber blends which include both cellulosic and non-cellulosic fibers, may also be treated by the process of this invention. Such fibers may be incorporated in the fill yarn or the dyed warp yarn or both. Examples of such denim textiles containing less than 100% cellulose fibers are so-called "stretch" blends which may, for example, be blends which comprise 65% cotton and 35% of synthetic polyester fibers. The process is advantageously practised with dyed denim articles of apparel in otherwise finished product form. Particularly contemplated as such articles of apparel are pants, jeans, skirts, shirts and jackets.

According to one aspect of the inventive process, the denim textiles are contacted in a single aqueous bath which comprises effective amounts of a cellulase enzyme, a direct dye, and a salt under process conditions which allow for the action of both the cellulase enzyme and the direct dye to both degrade and overdye the denim textile.

In accordance with a further process of the present invention, the denim textiles are preferably first desized. Desizing of the denim textile may be according to conventional techniques including contacting the denim textiles with one or more baths containing desizing agents, such as conventional desizing agents or an effective amount of an amylase enzyme.

In accordance with a further aspect of the invention, the denim textiles do not have to be desized first if amylases and cellulases are used simultaneously according to certain processes of the present invention.

The relative proportions of the constituents used in accordance with the single bath process taught herein are to be understood as being variable over a wide range and are in great part dependent upon the ultimate textile treatment to be effected. Variables to be considered include process conditions such as time, temperature, concentration, as well as other conditions which may be dependent upon the process and/or apparatus which are to be utilized. Further variables effecting the amount of

constituents include considerations related to the particular constituents selected, such as the particular cellulase enzyme preparation and direct dye selected. Other considerations dependent upon the desired final product include the ultimate degree or depth of dyeing which is desired, and the ultimate degree of textile softening or stonewashing effect which is to be imparted to the textile by the treatment process. These relative proportions may be determined by routine experimental evaluation. By way of non-limiting example, various exemplary process conditions as well as single bath compositions are provided in the Examples described in detail below.

Treatment baths may also include further constituents which are conventional to the textile treatment arts. By way of example, but not by way of limitation, these include wetting agents, suspension agents, dispersants, surfactants, leveling agents, buffering agents and the like. One or more of these additives may be added to the single baths according to the invention in any amount which is not found to undesirably limit the operation of the cellulase and the direct dye and where present the amylase.

The treatment baths may contain an acid and/or a buffer to establish or regulate the pH of the single bath so to be within the effective operating pH of the particular cellulase enzyme selected. A bath may be formed by the addition of the direct dye and the salt to the water, after which a sufficient amount of an acid is added to the single bath to adjust the pH to be within the effective operating pH range of the cellulase enzyme and of the amylase enzyme, where present, as well. The particular enzymes are then added to the single bath. Subsequently, a buffer may be added to the bath in a sufficient amount to regulate the pH to be substantially in the pH range wherein at least the cellulase enzyme exhibits its optimal activity. For these purposes, useful acids include inorganic or organic acids. Particularly contemplated as useful acids are organic acids such as acetic, citric and oxalic acids. As useful buffering agents come into contemplation conventional buffering agents including monosodium buffering agents such as sodium acetate, sodium carbonate, sodium phosphate and

sodium hydroxide containing buffering agents. Typically effective amounts range from 1 to 6 grams per liter of the single bath water. These amounts are more preferably in the range of from 2 to 4 grams per litre of water.

A useful further constituent which may be included in the bath is a surfactant. Such surfactants desirably exhibit a good detergent action, and may be of the non-ionic, amphoteric and/or anionic type. Preferably the surfactants are of the non-ionic or involve mixtures of non-ionic types with a minor portion, up to 30% of an amphoteric or anionic type. The surfactants facilitate the treatment and are also effective for the substantial desizing of the fabric, such as starch or other desizing agents. The amount of surfactant will typically range from about 0.5 to 5.0 grams per litre of bath water, preferably from 0.5 to 1.5 grams per liter of water.

In the processes according to the invention, the concentration of the salt may be varied to increase the effectiveness of the dyes being used, and therefore increase the percentage of dye exhaustion onto the textile. In comparisons of single baths according to the invention containing a cellulase enzyme and a direct dye (for example, Pyrazol® Fast Turquoise FBL) at a pH of 4.5, and a temperature of 60°C, increasing the salt concentration from 10 grams per litre of bath liquid to 20 grams per liter of bath liquid was observed to improve the dye exhaustion from 84% to 90%. It can, therefore, be seen that the present process may utilize salt concentrations in excess of those which would normally be expected to be useful or particularly recommended for use with the particular direct dye selected.

Following treatment in the single bath taught herein, the denim textile may be rinsed as desired. The rinses may be hot or cold water rinses and generally a plurality of rinses is used. One or more of the rinses may also include a scavenger for dye components which may have been freed or remain as residual products from the single bath process. Such products include those conventionally known and used for such a purpose, such as those which are based on or include acrylate copolymers. One such known product is Sandopure® RSK which is presently commercially available from

Sandoz Chemicals, Basel, Switzerland. Such products may be used in conjunction with an alkali such as soda ash, and each is typically used in amounts of up to about 3% by weight based on the dry weight of the goods being treated.

Following treatment in the single bath taught herein, the denim textile may be subjected to further conventional treatment steps. Such conventional treatment steps by way of example include finishing steps, such as treatment with softening, finishing, lubricating agents.

In one embodiment of the invention, there is provided a textile treatment preparation which includes at least a cellulase and a direct dye, and optionally but preferably at least one salt in an effective amount to form a electrolyte. Such a textile treatment preparation is a concentrate which is useful in the later formation of an aqueous treatment single bath. The said cellulase is preferably a cellulase-containing preparation, especially a cellulase containing preparation of the type which is presently commercially available. As noted above, such commercially-available cellulase-containing preparations include those which are known to be useful to the textile arts for one or more purposes including stonewashing assistants and finishing agents. The said direct dye is preferably one or more direct dyes as may be described by the Colour Index. As an optional constituent but preferred for inclusion in the textile treatment preparation is the salt which is useful in conjunction with the direct dye of the composition. The textile treatment preparations, (i.e., concentrates,) may be produced by the simple addition of two or more of the constituents together by any effective means for producing mixtures. For example, where the cellulase enzyme preparation, the direct dye, the salt and any further optional constituents are in the form of normally dry solids, measured amounts of the respective constituents may be introduced to a mixing means, such as a powder mixer, mill or tumbler which are then operated for a sufficient period to ensure thorough blending of the respective constituents. In a further example, where one or more of the essential and optional constituents are in the form of a liquid or semi-solid (paste, gel, etc.), it is preferred to

independently mix the normally dry solid constituents to form a dry premixture, and then to mix the liquid or semi-solid constituents together to form a liquid premixture. Subsequently the dry premixture and the liquid premixture may be combined and mixed by any effective means to ensure thorough mixing of the constituents forming the textile treatment preparation. For example, the mixing of the dry premixture and the liquid premixture may be achieved by the use of a mixing vessel equipped with an agitator such as a mechanical paddle or magnetic stirring rod.

Alternatively, the textile treatment preparation as described above may further contain an amylase enzyme. Such may be commercially-available amylase-containing preparations and amylase- and cellulase-containing preparations including those which are known useful to the textile arts for one or more purposes including stone washing assistants and finishing agents. An example of a suitable preparation is Bactosol® MTN.

The textile treatment compositions may further comprise optional constituents including but not limited to those which have been discussed above, namely: wetting agents, suspension agents, dispersants, surfactants, leveling agents, buffering agents as well as further conventional constituents not particularly elucidated here. One or more of these additives may be added to the textile treatment compositions according to the invention in any amount which is not found to undesirably limit the operation of the cellulase and the direct dye.

Preferred forms of the textile treatment compositions are those wherein the constituents included are in a normally dry solid form. Dry forms of enzyme preparations are known.

A further preferred form of the textile treatment composition is one wherein the constituents may be in normally solid, liquid or semi-solid state but wherein the cellulase enzyme selected exhibits activity, preferably exhibits its optimum activity, at a pH or pH range which encompasses the pH or pH range of the direct dye. Such textile treatment compositions are expected to exhibit good long term storage stability.

It is also expected that textile treatment compositions having one or more non-dry solid constituents wherein the difference between the pH or pH range at which the cellulase enzyme selected exhibits activity, preferably exhibits its optimum activity, and the pH or pH range of the direct dye is minimized will also exhibit good storage stability.

It is to be further understood that where the preferred textile treatment compositions include optional constituents, it is preferred that such constituents be present in normally dry solid form, or be present in such amounts, or that such optional constituents have a pH or pH range, such that the overall pH of the textile treatment composition be within the active pH of the cellulase enzyme incorporated therein.

Single bath processes according to the invention may be carried out in any apparatus or process which may be used for effecting enzymatic treatment of denim textiles or garments and/or articles thereof. One form of useful apparatus is the commercial-type washing machine which is known for use in one-bath or two-bath processes. Typically the aqueous textile treatment bath will occupy about one-half of the capacity of the machine. The goods to be treated, namely the denim textile, garments and/or articles may be added at the beginning of the treatment process and are usually present in the machine in a quantity to give a weight ratio of goods to treatment bath which may range from 1:4 to 1:30, although the range of from 1:10 to 1:20 is more common. If pumice stones or other abrasive materials are to be added to enhance the abrasion of the denim textile, they are usually added at this time. The pumice stones or other abrasive materials are typically added to provide a weight ratio of pumice stones or other abrasive materials to water in the general range of 0.5:1 to 1:4. More typically, this range is from 1:1 to 1:3.

Subsequent to a desizing process step (although not necessarily immediately subsequent) the water is provided to the washing machine as a metered amount of both "hot" water (approximately 60°C) from a domestic or commercial hot water

supply and "cold" water (approximately 1-27°C). If the temperature is too low, it may be raised to a suitable level by appropriate heating means, such as a heating element which is conventionally provided as part of the washing machine. Once an appropriate temperature is attained, requisite amounts of the cellulase enzyme preparation, when desired amylase enzyme preparation, direct dye and salt according to the invention, as well as further optional constituents, are then added to the water to form the single bath according to the invention. Upon this addition, the treatment of the goods begins. It will be understood that if amylases and cellulases are used simultaneously in the single bath process of the invention, no prior desizing step is necessary.

Other sequences for the addition of the compositions according to the invention are contemplated to be within the scope of the invention, such as the addition of less than all of the constituents making up a composition at one time, and the subsequent addition of less than all of the remaining constituents or all of the remaining constituents at a later time. Such a sequential addition of the composition may be desirable under certain circumstances, such as may be contemplated when the cellulase enzyme and where present, the amlyase enzyme and other optional constituents (such as buffering agents) but not the dye is added to the bath to permit pretreatment of the goods prior in order to impart a stonewashing effect and only subsequently adding the dye and other remaining optional constituents to the single bath to begin the overdyeing of the goods at a later point in time. In any case, the dyeing is conducted in the presence of at least the cellulase.

A further sequence for the carrying out the single bath process contemplates the addition of the requisite amounts of the cellulase enzyme preparation, direct dye and salt according to the invention, as well as further optional constituents and then at a later time but prior to the conclusion of the treatment process adding a further amount of an acid or base to adjust the pH level of the bath in order to increase the activity of the direct dye and optionally deactivate the cellulase enzyme present. In a

further alternative sequence, an additional amount of salt is added prior to the conclusion of the treatment process to increase the activity of the direct dye. In a still further alternative sequence, the temperature of the single bath is raised from an inital single bath temperature to a higher temperature during the process, i.e., increasing the temperature to a temperature above that at which the cellulase enzyme exhibits itsoptimal activity, or increasing the temperature to a temperature which is observed to increase the exhaustion of the dye, especially a direct dye.

Subsequent to the treatment process, the liquid is removed from the goods, and the goods are preferably rinsed with one or more rinses. The single bath treatment process may be followed by further conventional treatment process steps such as by further washing, rinsing, or finishing process steps.

In one such rinsing process the goods are rinsed in two stages, first by rinsing with water at the temperature of the water used in the prior process and dumping the water, and afterwards, by rinsing with water at a temperature which is at a sufficiently low temperature so to remove any remaining cellulase enzymes which are entrained in the goods.

An important aspect of the invention is in the provision of simultaneous treatment to provide a worn appearance and overdyeing in a single-bath. Surprisingly, it has been found that this is achieved at temperatures which have not been known to the art to be particularly effective for the dyes used. In the case of the use of a conventional direct dye which normally has a dyeing temperature in the range of 88-94°C, the use of the cellulase enzyme as a dyeing assistant to the dye has been found to lower the effective dyeing temperature. It has been found that such direct dyes which had heretofore been known to be most effective at temperatures of approximately 88°C and higher, have now been found to be comparably effective at lower temperatures in the presence of the cellulase enzyme, at temperatures at which the cellulase enzyme is active. This depression in the effective dyeing temperature is typically 17-28 deg.C lower than that which is recommended for the particular direct

dye used. Therefore, it is now possible to practice a single-bath process where desired effects of both stonewashing and overdyeing are obtained.

The practice of such a single-bath process provides numerous technical advantages including reduced process time due to the simultaneous working of present enzymes and the direct dye; decrease in overall energy requirement which is realized by the effective depression in the temperature at which the direct dye is found to work, as well as time and material requirement savings. When an amylase is also included, further technical benefits include reduced amounts of starch desizing agents.

The goods treated in accordance with the present inventive teaching exhibit level dyeing of the goods as is observed in the overdyed fill yarns as well as good exhaustion of the direct dye which is used. Further, an increase in the salt content has been observed to increase the dye exhaustion. Improvement in the dye exhaustion reduces the quantity of dye which must be ultimately disposed of and is a technical benefit which is important in view of environmental and product waste disposal considerations.

The foregoing invention will be more apparent by reference to specific embodiments which are representative of the invention. It is nonetheless to be understood that the particular embodiments described herein are provided for the purpose of illustration, and are not to be construed as limiting the invention in any way, and that it is to be further understood that the present invention may be practised in a manner which is not exemplified herein without departing from its scope.

Examples:

Example A

To a front loading Unimac 30 washing machine are provided 0,77 kg of a denim textile in the form of dyed blue jeans and 0,77 kg of a denim textile in the form of textile swatches. The denim textile is dyed on the warp yarns with

conventional indigo and sulfur dyes, and the fill yarns are undyed. To effect desizing of the denim, to the machine is added 28 liters of water at approximately 37,7°C, to which is added 7,7 g (or, 1% by weight based on the dry denim textile) of Sandoclean® PCA, a conventional non-ionic detergent composition (available from Sandoz Chemical Inc.), and 15,4 g (or, 2% by weight based on the dry denim textile) of technical grade soda ash. The goods:liquor ratio is 1:18. The temperature of the water in the machine is raised to 60°C by operating the integrated heating element of the machine and then the agitator of the machine is energized to operate at a "slow" setting for a period of 10 minutes. At the slow setting the agitator operates for 3 seconds and then pauses for 12 seconds, each time reversing the direction of rotation of the agitator. The rotational speed of the agitator is 30 rpm. Subsequently, for a further 5 minute period the machine is operated at a "wash" setting wherein the agitator operates for 12 seconds and then pauses for 3 seconds, each time reversing the direction of rotation of the agitator. The rotational speed of the agitator is 30 rpm. Afterwards the liquid contents of the machine are removed. The contents of the machine are then subjected to two successive rinsing operations where 28 liters of water at 37,7°C are provided to the machine, the machine is operated on the wash setting for 3 minutes after which the liquid contents of the machine are removed. At this time any sizing agent present in the goods is substantially removed.

The single bath process according to the invention is formed by adding 28 liters of water to the machine at 37,7°C and subsequently raising and controlling the temperature of the bath by means of the integrated heating element to a temperature in the range of 57,2-58,8°C. To the water is added 7 grams (0.25 grams/litre of bath) of a conventional non-ionic detergent which acts as a wetting agent and 14 grams (0.5 grams/litre of bath) of 56% acetic acid to adjust the pH to 4.5-5.5. Subsequently is added cellulase enzymes commercially available as Bactosol® CA which is indicated by the manufacturer to be optimally active at a temperature of approximately 55-65°C, at a pH in the range of 3.8-5.5. Present in the machine is a cellulase enzyme

concentration of 2940 CMC units per lb. of denim. Afterwards is added 560 grams (20 grams/litre of bath) of Glauber's salt and 1% by weight (based on the dry denim textile) of a direct dye solution Lumicrease® Orange 3LG (Colour Index Direct Orange 107) (available from Sandoz Chemical Inc.) which is prepared from a dry form according to the manufacturer's instructions. The machine is operated at the "wash" setting for 45 minutes, after which the liquid is removed from the machine. The treated denim is observed to have been effectively overdyed. It is also observed that good exhaustion of the dye is achieved by visual inspection of a sample of the liquid as it is removed from the machine.

Following the single bath treatment process, to the machine is added 28 liters of water at 37,7°C and the machine is operated at the "wash" setting for 3 minutes to rinse the textile, after which the liquid is removed from the machine.

After rinsing, 28 liters of water at 37,7°C are added to the machine to which is then added 1% of a conventional polyacrylate containing dirt/dye suspension agent, Sandopure® RSK also available from Sandoz Chemicals Inc.. The temperature is then raised to 60°C by means of the integral heating element, and the machine is operated at the "wash" setting for 5 minutes. The liquid contents of the machine are then removed. Subsequently the denim textile is again rinsed by adding 28 liters of water at 37,7°C and operating the machine at the "wash" setting for 3 minutes to rinse the textile, after which the liquid is removed from the machine.

Next, the denim textile is treated in accordance with a conventional finishing process. To the machine is added 28 liters of water at 37,7°C and 7,7 g 1 % by weight (based on the dry denim textile) of Ceranine ®HCA (Sandoz Chemical Inc.) a conventional cationic finishing agent used to impart lubricative, antistatic and softening properties to the textile. The machine is run on the "wash" setting for 5 minutes at a water temperature of 37,7°C after which the liquid is removed from the machine.

The denim textile, i.e., "blue jeans" are extracted from the machine and dried

in a conventional residential clothes dryer after which the blue jeans are removed and inspected. The denim textile is observed to be uniformly overdyed, providing a color cast to the previously dyed warp yarn and further with good coloration by the direct dye evident at abrasion points, seams, and in the fill yarn. The goods both a stone-washed effect and are overdyed in the single bath process.

The actual strength of dyeing is determined by establishing the dye exhaustion in accordance with the following test.

Dye exhaustion.

Two 20 gram pieces of bleached white cotton textile are provided.

To a first 500 ml laboratory beaker is provided one piece of textile, to which is added 495 ml of water at 87,8°C, 5 grams (10 grams/litre of water) of Glauber's salt, and 1% by weight (based on the dry denim textile) of a direct dye solution Lumicrease® Orange 3LG (Colour Index Direct Orange 107) which has been prepared according to the manufacturer's directions. The contents of the beaker are automatically stirred for 45 minutes on an apparatus which continually rotated the beaker at a speed of 60 rpm. Afterwards the textile is removed, and it is visually observed that all of the dye in the beaker has been exhausted and deposited upon the textile. The piece of textile is labeled as the "color control" and assigned a value of 100%, representative of complete dye takeup by the textile and exhaustion of the dye in the bath.

To a second 500 ml laboratory beaker is provided the other piece of cotton textile, to which is added 494 ml of water at 60°C, 5 grams (10 grams/litre of water) of Glauber's salt, sufficient acetic acid (58%, technical grade) 0.5 grams of Bactosol® CA (1 gram per litre of water) and 1% by weight (based on the dry denim textile) of a direct dye solution Lumicrease® Orange 3LG (Colour Index Direct Orange 107) which has been prepared according to the manufacturer's directions. The contents of the beaker are stirred for 45 minutes on an apparatus which continually

rotated the beaker at a speed of 60 rpm. Afterwards the textile is removed. The piece of textile is labeled as the "dye exhaustion sample". Using an ACS Model CS5 Chromasensor spectrophotometer the light reflectance of the textile pieces are measured to provide a comparison of the relative takeup of the dye in the second laboratory beaker as compared to that of the first laboratory beaker. The "dye exhaustion sample" is determined to have exhausted 84% of the direct dye in the bath. Further, as the conditions of the bath in the second beaker are as close as possible approximation of the conditions in the washing machine, the same dye exhaustion is assumed to have occurred in the washing machine, and the dye exhaustion in the washing machine is assigned a value of 84%.

This test is used to determine the percentage of dye exhaustion as spectrophotometer cannot accurately read the amount of a direct dye absorbed by the denim textile due to the presence of the other dye used to originally dye the denim textile.

Example B

The processes according to Example A are repeated, except that as the direct dye Lumicrease® Yellow 3LG (Colour Index Direct Yellow 98) (available from Sandoz Chemicals Inc.) is used in the place of Lumicrease® Orange 3LG. As in the prior Example, the treated denim is observed to have effectively been overdyed by the Lumicrease® Yellow 3LG. The textile is observed to be uniformly overdyed, providing a color cast to the previously dyed warp yarn and good coloration by the direct dye evident at abrasion points, seams, and in the fill yarn. Evaluation of the dye exhaustion by visual inspection indicated very good dye exhaustion, estimated in excess of 80%.

Example C

The processes according to Example A are repeated, except that as the direct

dye Lumicrease® Red Violet 3LB (Colour Index Direct Violet 47) (available from Sandoz Chemicals Inc.) is used in the place of Lumicrease® Orange 3LG. As in the prior Example, the treated denim is observed to have effectively been overdyed by the Lumicrease® Red Violet 3LB. Good exhaustion of the dye is observed. The textile is observed to be uniformly overdyed, providing a color cast to the previously dyed warp yarn and good coloration by the direct dye evident at abrasion points, seams, and in the fill yarn. Evaluation of the dye exhaustion indicated that 80 % of the direct dye is exhausted.

Example D

The processes according to Example A are repeated, except that as the direct dye Pyrazol® Fast Turquoise FBL (Colour Index Direct Blue 199) (available from Sandoz Chemicals Inc.) is used in the place of Lumicrease® Orange 3LG. As in the prior Example, the treated denim is observed to have effectively been overdyed by the dye Pyrazol® Fast Turquoise FBL. Good exhaustion of the dye is observed. The textile is observed to be uniformly overdyed, providing a color cast to the previously dyed warp yarn and good coloration by the direct dye evident at abrasion points, seams, and in the fill yarn. Evaluation of the dye exhaustion indicated that 84 % of the direct dye is exhausted.

Example E

The processes of the previous examples are repeated except that the denim textiles were not desized prior to the single bath process and instead of cellulase enzymes commercially available as Bactosol ® CA, 1-1.5 % by weight (based on the dry denim textile) of a mixture of cellulases and amylases commercially available as Bactosol FB fl. are used.

Claims:

1. A single bath process for obtaining a stone washed and overdyed appearance on a dyed denim textile or denim textile-containing article comprising the process step of: contacting the denim textile or denim textile-containing article with an aqueous bath containing a water-soluble or water-dispersible dye and a cellulase enzyme at pH and temperature conditions at which the cellulase enzyme exhibits activity for a time sufficient to effect a stone washed and overdyed appearance on dyed denim textile.

2. A single bath process according to claim 1 wherein the cellulase enzyme exhibits its activity in the pH range of 3.8-6.5 and in the temperature range of 35-65°C.

3. A single bath process according to claim 1 or 2 wherein the cellulase enzyme exhibits its optimal activity in the pH range of 3.8-5.5 and in the temperature range of 55-65°C.

4. A single bath process according to any one of the preceding claims wherein the aqueous bath further contains a salt.

5. A single bath process according to any one of the preceding claims wherein the dye is a direct dye.

6. A single bath process according to any one of the preceding claims wherein the aqueous bath further contains an amylase enzyme.

7. An aqueous bath composition for imparting a stone washed and overdyed appearance on denim textile or a denim textile containing article which comprises a

water or water-dispersable dye and a cellulase enzyme.

8. An aqueous bath composition according to claim 7 in which the dye is a direct dye.

9. An aqueous bath composition according to claim 7 or 8 which further comprises a salt.

10. An aqueous bath composition according to any of claims 7 to 9 which further comprises an amylase enzyme.

11. A textile treatment composition which comprises:

a cellulase enzyme, a direct dye and a salt wherein the salt is included in an amount in excess of that normally expected to be useful at 88-94°C with the amount of the direct dye included in the textile treatment composition.

12. The use of a cellulase enzyme in a single bath process for overdyeing a dyed denim textile fabric.

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A J RUDGE

Date of completion of Search
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Databases (see below)
(i) UK Patent Office collections of GB, EP, WO and US patent specifications.

(ii) ONLINE DATABASES: WPI, CLAIMS

Documents considered relevant following a search in respect of Claims :-
ALL

Categories of documents

X: Document indicating lack of novelty or of inventive step.

Y: Document indicating lack of inventive step if combined with one or more other documents of the same category.

A: Document indicating technological background and/or state of the art.

P: Document published on or after the declared priority date but before the filing date of the present application.

E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.

&: Member of the same patent family; corresponding document.

Category	Identity of document and relevant passages	Relevant to claim(s)
X; A	JP 010060661 A (PENTEL KK) see abstract supplies	7; 11

Databases: The UK Patent Office database comprises classified collections of GB, EP, WO and US patent specifications as outlined periodically in the Official Journal (Patents). The on-line databases considered for search are also listed periodically in the Official Journal (Patents).

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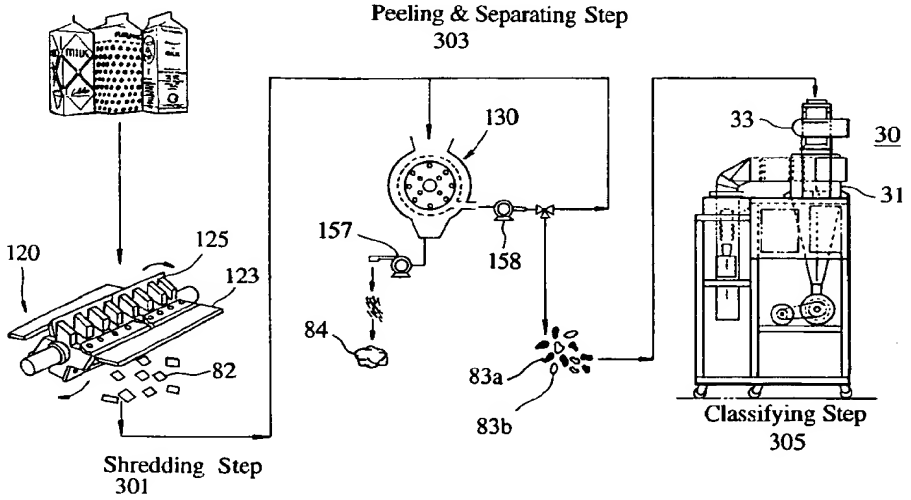
(54) Method and apparatus for recycling laminated film

(57) A method and apparatus for individually collecting layers from a laminated film containing many layers made of different materials by peeling or separating the layers one from the other. The laminated film having a plurality of layers made of different materials is shredded (120) into a plurality of fragments to be processed (82); and the fragments to be processed are peeled or separated (130) according to the type of layer by applying an impact frictional striking force to each of the fragments to be processed (82). Subsequently, the peeled or separated layers obtained (83a,83b) in the peeling and separating step (130) are subjected to a wind force classifying step (30). The collected layers in the mixed state are separated from one another, and they are individually collected.

FIG. 1



EP 0 801 168 A1

Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a method and apparatus for recycling laminated films. For instance, the laminated films may comprise a milk carton (a milk container made of paper), a retort pouch used for packaging a brick-type paper container or packaging curry sauce or stew, a laminated film which includes an aluminum foil layer and is used as wrapping paper for chocolate bars, and various types of laminated films which are composed of a plurality of different materials such as paper, aluminum foil, and plastic film. The present invention relates to a method and apparatus for individually collecting layers forming a laminated film by peeling and separating them from one another. More preferably, the present invention relates to a method and apparatus for reproducing high-quality virgin materials from pulp of the laminated film including a layer of paper (hereinafter referred to as a paper layer).

2. Description of the Prior Art

A laminated film combines the lightweight and ease-in-processing features of paper, the waterproof and heat-sealing characteristics of plastic film, and the gas barrier properties of aluminum foil. Further, the laminated film is relatively easily disposed of after it has been used. Because of these features, it is very popular to package articles in a laminated film which is made using laminating or coating techniques. One type of package particularly widely used is a paper container with a laminated film (hereinafter simply referred to as a paper container) which is made of a paperboard sandwiched between layers of plastic film, as shown in Fig. 7. The paper container of this type is used for containing milk, etc. Another paper container with a laminated film is made of a paperboard having both ends covered with aluminum foil and plastic films further laminated on the aluminum foil. This type of paper container is used for containing long-life milk, fruit juice, and so forth. Even when counting only milk packages, nine million packages or more are produced every day throughout Japan.

The above-mentioned packaging containers have normally been discarded together with flammable wastes before incineration. As described above, laminated films include layers made of various materials, and hence simple incineration of the laminated films may generate noxious fumes or environmental pollution. If the waste laminated films could be recycled, it would be possible to contribute to the preservation of the environment as well as to the conservation of natural resources which tend to become depleted.

However, it is difficult to recycle the above-described laminated films comprising a plurality of different material layers. Although the laminated films including paper layers have so far been recycled, the laminated films comprising many different material layers are never recycled yet. In the meantime, laminated films comprising paper layers are recycled in the same manner as waste paper is recycled in a manner described below, and therefore, various problems are encountered in the recycling of such laminated films.

As an initial step, the laminated films which include paper layers are introduced together with water and chemicals into a bath having mixing vanes. Paper included in the laminated films is disaggregated in water and fibrously disentangled. Foreign substances are eliminated from a suspension in which the fibrous paper is mixedly included. To more completely disaggregate the paper, the suspension is introduced into a high-speed disaggregating machine. The thus disaggregated suspension passes through a mesh filter, so that plastic film and aluminum foil are removed from the suspension. Subsequently, sodium hydroxide, which acts as a deinking agent; alkaline chemicals; and a detergent are mixed into the suspension in which the laminated film is disaggregated. Shredded plastic sheets, aluminum foil, and small foreign particles such as hair are again eliminated, and the suspension is then dehydrated. The resultant pulp is fed to a bleaching process, whereby bleached pulp is recovered.

In the above described conventional method of recycling the laminated films comprising paper layers, the films are mixed in a liquid substance in order to fibrously disentangle the paper in the laminated films. Printed layers come away from the surface of the laminated films and are dispersed in the suspension. As a result, the thus-recovered paper fibers are colored by the dispersed ink.

It is difficult to completely recover the fibrous paper layers from the suspension while leaving other substances behind. Unrecovered fibrous paper, shredded plastic films, and aluminum foil remain mixed in a waste liquid from which the paper fibers have been recovered. It is necessary to recover these mixed substances by precipitating them in a settling bath before disposing of the waste liquid.

Further, it is necessary to neutralize the chemicals introduced in the waste liquid when disposing of the waste liquid in which various chemicals are mixed. Various costs incurred by the steps and equipment required to carry out the neutralizing operation are considerably large.

According to the above described conventional recycling method, it is possible to recover paper layers from the laminated films comprising the paper layers, but it is impossible to individually recover the plastic film layer and the aluminum foil layer in a recyclable manner.

SUMMARY OF THE INVENTION

The present invention has been conceived in view of the foregoing drawbacks in the conventional art, and

the object of the present invention is to provide a method and apparatus which recycles laminated films, particularly laminated films including paper layers, in a manner completely different from that of a conventional method. That is, the object of the present invention is to recycle laminated films by affording an impact frictional striking force to the laminated films. More specifically, an object of the present invention is to make it possible to recycle laminated films which do not include any paper layers;

Secondary, another object of the invention is to make it possible to prevent recycled paper fibers from being colored by ink which has come away from the surface of the laminated films;
Thirdly, further object of the present invention is to make it possible to eliminate the necessity of disposing of a waste liquid when the paper fibers are recovered and, therefore, to omit equipments required to dispose of the waste liquid;
the fourth object of the present invention is to make it possible to substantially completely separate from one another and individually recover a paper layer, a plastic film layer, and an aluminum foil layer which form the laminated film; and
the fifth abject of the present invention is to make it possible to easily and inexpensively recycle the laminated films without requiring the disposal of the waste liquid, a step of neutralizing chemicals, or an associated processing equipment to carry out these operations.

In order to accomplish the above objects, according to one aspect of the present invention, there is provided a method of recycling laminated films which include a plurality of layers made of different materials, the method comprising at least the following steps of:

shredding the laminated films into a plurality of fragments to be processed 82; and
peeling or separating layers of the fragments to be processed 82 according to the type of layer, by applying an impact frictional striking force to each of the fragments to be processed 82 formed in the shredding step.

According to another aspect of the present invention, the laminated film recycling method defined above further comprises at least step of classifying the separated or peeled layers of the fragments to be processed 82 one from the other in the preceding peeling and separating step.

If each of the layers peeled in the peeling and separating step is struck into substantially the same size by means of the impact frictional striking force, it will be more preferable to provide the method with of classifying, using a wind force, the peeled or separated fragments to be processed 82 and collecting the layers according to the type of layer.

It will be preferable for the laminated films to be processed in the preceding step to include at least a paper layer.

Specifically, the laminated film recycling method comprises the step 303 of peeling or separating a laminated film having layers of a paper and of a plastic film into a fibrously struck and separated paper layer and a plastic film layer 83a formed into a thin strip, and collecting the fibrously separated paper layer as aggregated and flocculated paper fibers, which have substantially the same length as material pulp and are free from stranded fibers even as a result of the separating operation, by classifying the separated paper layer from the plastic film layer 83a.

If the laminated films to be processed include an aluminum foil layer in addition to the paper layer and the plastic film layer, the laminated film recycling method further comprises the step of classifying the mixture of plastic film layer 83a and the aluminum foil layer 83b from the preceding step by means of a wind force for individually recovering the plastic film layer 83a and the aluminum foil layer 83b.

According to still another aspect of the present invention, there is provided an apparatus for recycling laminated films having a plurality of layers made of different materials, the apparatus comprising:

shredder which shreds the multilayered films into a plurality of fragments to be processed 82;
fixed-side peeling and separating means which includes a fixed disk whose center communicates with an inlet port for introducing the fragments to be processed 82 and pins fixedly provided on the fixed disk 131 so as to trace out a plurality of rotary trajectories; and
movable-side peeling and separating means which includes a movable disk rotatably provided so as to be opposite to the fixed disk and movable pins provided on the movable disk so as to trace out a plurality of rotary trajectories different from those that the fixed pins trace out.

The laminated film recycling apparatus preferably further comprises:

collecting means which is disposed along the outer periphery defined by combination of the fixed pins and the movable pins and which communicates with an outlet port via a screen having small apertures formed therein, each aperture of a predetermined diameter;
means for taking out the separated fragments remaining in the screen via the outlet port; and
peeling and separating means for peeling or separating the layers of the laminated films according to the type of layer by impacting upon and striking the fragments to be processed 82 between the fixed pins 134 and the movable pins using the impact frictional striking force.

If the fragments to be processed 82 include a plurality of peeled or separated layers, the laminated film recycling apparatus preferably further comprises wind force classifier which classifies the peeled or separated layers by a wind force, and which individually collects the layers peeled or separated from the fragments to be processed 82 as a result of the classifying operation.

BRIEF DESCRIPTION OF THE DRAWINGS

The objects and advantages of the invention will become understood from the following detailed description of preferred embodiments thereof in connection with the accompanying drawings in which like numerals designate like elements, and in which:

Fig. 1 is a system diagram which schematically shows the outline and principle of a shredding step, a peeling and separating step, and a wind force classifying step in the process of recycling laminated films according to one embodiment of the present invention;
Fig. 2 is a longitudinal cross-sectional view which schematically shows the outline of the construction of shredding means;
Fig. 3 is a longitudinal partial cross-sectional view which schematically shows the outline of the construction of a peeling and separating unit used in the peeling and separating step according to the present invention;
Fig. 4 is a plan view of the peeling and separating unit shown in FIG. 3;
Fig. 5 is a schematic front view for illustrating the peeling and separating operations according to the present invention;
Fig. 6 is a schematic representation which shows an example of the use of the peeling and separating unit used in the peeling and separating process according to the present invention; and
Fig. 7 is a schematic representation showing the structure of a milk carton which is one example of an object to be processed by the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Laminated Films to be Processed by Recycling Method and Apparatus according to the Present Invention

A method and apparatus for recycling a laminated film according to the present invention recycles, for example, the following laminated films as raw materials:

a laminated film which is composed of a paperboard having both sides coated with a polyethylene (PE) film and is used as a tetrapak (Registered Trademark), or the like;
a paper container (a gable-top-type paper container) for packaging purposes which is made of a laminated film, the laminated film comprising either paper having one side coated with a polyethylene (PE) film and the other side coated with an IR film or paper having one side coated with an IR film, aluminum foil, and an IR film, in that order, and the other side coated with a PE film, an EVOH film, or the like;
a laminated film which is made by recycling brick-type paper containers, or the like, and which has various types of paper layers; the brick-type paper containers comprising paper having one side coated with an IR film, aluminum foil, an IR film, and a PE film and the other side coated with a PR film;
a laminated film comprising a layer made of aluminum foil and a plastic film and another layer made of paper and aluminum foil; and
a laminated film comprising a plurality of types of layers which are made of various materials.

Taking the facts that an object to be recycled should be stably available and that applications of recycled products should be established into consideration, a laminated film comprising a paper layer used in, for example, a milk container made of paper, is preferable as an object to be recycled.

The method and apparatus for recycling a laminated film comprising a paper layer, and a method and apparatus for recycling another laminated film will be described hereinbelow.

Means for recovering layers of the laminated film by peeling and separating them one from the other will now be described. The means comprises at least a shredding step 301 for shredding laminated films which were recovered from wasted laminated films, the paper containers, or the like, into fragments to be processed 82; and a peeling and separating step 303 in which the fragments to be processed 82 are struck by an impact frictional striking force and the thus-struck fragments are peeled and separated into layers.

If the layers of the laminated films are struck and separated into different sizes as a result of the application of an impact frictional striking force in the peeling and separating step 303, the separated layers can be classified by size in this step. The separated layers which remain unclassified can be classified and recovered for each layer by a wind force in a wind force classifying step 305 by taking advantage of the difference in specific gravity of the materials of the layers (see Fig. 1).

Shredding Step 301

The laminated films recycled as wasted milk carton or juice containers are shredded into fragments having suitable sizes by a shredder as a means of shredding means 120 such as a shredder, as shown in Fig. 1, preferably after having been cleaned. For example, the laminated films are shredded into fragments to be processed 82 which have a side of about 6 to 10 mm.

The shredding means 120 shreds objects to be

shredded, such as the paper containers made of the laminated films, into the fragments to be processed 82 having a suitable size. In the present embodiment, a milling cutter is used as the shredding means 120. Figs. 1 and 2 show one example of the milling cutter.

A milling cutter main body 121 is provided with an inlet port 123 through which are introduced objects to be shredded, such as paper containers made of the laminated films.

A cutter support 124 is vertically supported between the inner side walls of the milling cutter main body 121 so as to be vertically rotatably actuated by driving means (not shown). Four rotary blades 125, which are oriented with their long axes in the direction perpendicular to the milling cutter main body, are attached to the cutter support 124 along its outer periphery. These four rotary blades 125 are arranged 90 degrees apart in the rotating direction of the cutter support 124, and they are also arranged so that all trace out the same rotary trajectory. Two fixed blades 126 are attached to the milling cutter main body 121 so as to be opposite to the four rotary blades 125 with a small clearance between the fixed blades 126 and the rotary blades 125.

The two fixed blades 126 are arranged along the rotary trajectory of the rotary blades 125 in a substantially symmetrical pattern with respect to the diameter of the cutter support. Objects to be shredded are shredded between the rotary blades 125 and the fixed blades 126 as a result of rotation of the rotary blades 125.

The clearance between the fixed blades 126 and the rotary blades 125 can be freely adjusted so as to shred an object into a desired size. In the present embodiment, the clearance is set in the range of 0.2 to 0.3 mm. The vicinity of the rotary trajectory of the rotary blades 125 is surrounded by a mesh screen 129, except at the inlet port 123. The screen 129 has meshes which permit the passage of the fragments to be processed 82 having a side of about 10 mm. A screen receiver is further provided outside the screen 129 so as to surround it with a predetermined space between them. The fragments to be processed 82 which have passed through the screen 129 are recovered between the space between the screen 129 and the screen receiver. The screen receiver is arranged so that it can be opened and closed, whereby the fragments to be processed 82 which have passed through the screen 129 can be discharged outside the milling cutter main body 121.

In the milling cutter 120 having the above-described construction, the objects to be shredded, which are described hereinabove, are introduced into the milling cutter through the inlet port 123, and the cutter support 124 is rotated by the drive means (not shown). The objects to be shredded are struck between the rotary blades 125 of the cutter support 124 and the fixed blades 126, and the thus-struck objects are then screened by the screen 129. As a result, there are formed square fragments to be processed 82 which are indefinite in shape and area but have a side of about 6 to 10 mm. The screen receiver is then opened so as to allow recovery of the fragments to be processed 82, which are subsequently fed to the next step.

The shredding means used for the present invention is not limited to the milling cutter 120. Any type of cutter capable of shredding objects to be shredded into fragments having a side of about 6 to 10 mm is applicable to the present invention.

It is also possible to wet the fragments to be processed 82 with water before and after the shredding process, before the next process, or during the course of the next process so as to promote the disaggregation of the fragments, as required.

Peeling and Separating Step 303

An impact frictional striking force is applied to the thus-struck fragments to be processed 82. If the fragments to be processed 82 comprise layers of paper and plastic films, the paper layer is struck, separated and disentangled into minute fibers.

The plastic film is separated into plastic film fragments 83a having a size of about 2 to 6 mm. If the fragments to be processed 82 comprise a layer of aluminum foil in addition to the paper and plastic film layers, the aluminum foil layer is separated into aluminum foil fragments 83b having a size of about 2 to 6 mm, in addition to the above-described paper and plastic film fragments. The fibrous paper layers are then classified from the plastic film fragments 83a, or from the mixture of the plastic film fragments 83a and the aluminum foil fragments 83b, whereby aggregated and flocculated paper fibers 84 are recycled. This process can be repetitively carried out several times, as necessary.

As in the case where the fragments to be processed 82 which are subjected to the peeling, separating and classifying step 303 comprise, for example, an aluminum foil layer and a plastic film layer, if the layers of the fragments to be processed are separated into substantially the same size, it is possible to arrange the system in such a way that the fragments to be processed are fed to the next process without undergoing the classifying operations in this step, and that they are classified and recovered according to the type of layer in the next process; that is, the wind force classifying step 305 using wind force classifier.

For convenience's sake, in the present embodiment, the peeling and separating means including classifying means used in the above described step is called a separator.

As shown in Figs. 3 to 6, a separator 130 has an inlet port 132 which communicates with the center of a fixed disk 131 so as to introduce the fragments to be processed 82 into the separator 130. A fixed end plate 133 is positioned so as to be opposite to the fixed disk 131 with a processing space 155 ensured between them. The outer periphery of the fixed disk 131 is fixed to the outer periphery of the fixed end plate 133 by means of a circumferential side plate 135. A movable

disk 141 is provided in the processing space 155 so as to be rotated by a horizontal rotary shaft 142. The horizontal rotary shaft 142 is supported by bearings 143, 143. The horizontal rotary shaft 142 is rotated by rotating means such as a motor.

In the present embodiment, a plurality of fixed pins 134 are attached at right angles to the fixed disk 131 so as to form a plurality of concentrically circular patterns (which are relative to the movable disk 141); e.g., six concentrically circular patterns a1 to a6 (Fig. 5). The fixed pins 134 are disposed on the fixed disk 131 from its center to its outer periphery in the concentrically circular patterns with a greater number of pins 134 in each successive layer; namely, 16 - 24 - 32 - 36 - 40 - 42. On the other hand, movable pins 144 which are different in number from the fixed pins 134 are attached at right angles to the movable disk 141. They trace out six rotary trajectories b1 to b6 so as to form alternating circular rows of rotary trajectories and concentric circular patterns. The movable pins 144 are disposed on the movable disk 141 from its center to its outer periphery in the following numbers: 4 - 4 - 4 - 4 - 4 - 6. The fixed and movable pins 134 and 144 are positioned with respect to each other such that the fragments to be processed 82 undergo peeling and separating effects by means of the impact frictional striking force between them. A screen 151 is circumferentially provided between the outer periphery of the movable disk 141 and the circumferential side plate 135 so as to ensure a predetermined circumferential discharge space 156 between the screen 151 and the side plate 135. Small apertures of a desired size are punched in the screen 151 having predetermined meshes. An exit 152 is formed below the discharge space 156. A blower 157 communicates with the separator 130 via the exit 152, as shown in Fig. 6.

The exit 152 is then connected to a collecting tank 250 via a discharge pipe 239 attached to the blower 157. A three-way solenoid valve (not shown) is disposed downstream the blower 157, and two other collecting tanks 250 (i.e., a total of three collecting tanks 250) communicate with the exit 152 via the discharge pipes 239. With this arrangement, high-purity paper fibers can be recycled, as will be described later.

A screen with apertures of a diameter of about 0.8 to 2.0 mm is used as the screen 151, depending on the number of rotations of the movable pins which will be described later. For the blower 157, either a large blower rated at 37-hp, 5 kg/ cm^2, 2 m^3/min or a compact blower rated at 18.5-hp, 5kg/ cm^2, and 1 to 1.5 m^3/min. is used with either of the blowers being capable of applying a suction force to the fibrous paper layers together with air in the separator 130.

An outlet port 153 is formed in the lower part of the screen 151 within the processing space 155 (Fig. 3).

The frictional striking force applied to the fragments to be processed 82 is reduced by increasing the clearance between the fixed and movable pins 134 and 144, whereas it is increased by decreasing the clearance.

A blower 158 communicates with the outlet port 153 so as to introduce air into the separator 130 by a suction force, as shown in Fig. 1. The outlet port 153 may be connected to the inlet port 132 via the blower 158. Further, the outlet port 153 may be connected to the processing space 155 via a communicating pipe 235, as shown in Figs. 3 and 6. Compressed air which is supplied from a compressed air source (not shown) and which returns from the outlet port 153 to the processing space 155 is introduced into the communicating pipe 235 via a pipe 236. As a result, the separated plastic film fragments 83a and aluminum foil fragments 83b which are discharged from the outlet port 153 may return again to the processing space 155 of the separator 130.

A branch pipe 237 is provided in the communicating pipe 235 in the vicinity of the inlet port 132 so as to communicate with a collecting tank 240 for collecting the plastic film fragments 83a or the mixture of the plastic film fragments 83a and the aluminum foil fragments 83b. A two-way solenoid valve 238 which is switched at a predetermined time using, e.g., a timer, as required, is disposed at the branch point of the branch pipe 237. The downstream end of the communicating pipe 235 is closed by a solenoid valve, and the branch pipe 237 is opened. As a result, the plastic film fragments 83a or the mixture of the plastic film fragments 83a and the aluminum foil fragments 83b remaining in the screen 151 are introduced, by a suction force, into the collecting tank 240 via the branch pipe 237. Alternatively, solenoid valves may be respectively disposed at the branch pipe 237 and the downstream side of the communicating pipe 235 such that these two solenoid valves are alternately opened and closed (Fig. 6).

The horizontal rotary shaft 142 is rotated by rotating means such as a motor, so that the movable disk 141 is also rotated. At this time, if the fragments to be processed 82 are introduced into the inlet port 132, the fragments to be processed 82 are subjected to an impact frictional striking force, which develops between the fixed and movable pins 134 and 144, in the center of the processing space 155. As a result, the paper and plastic film layers, or the paper, plastic film, and aluminum foil layers of the fragments to be processed 82 are peeled off or separated from one another. Among these layers, the paper layer is disentangled into minute fibers by means of the impact frictional striking force. In contrast, the plastic film and aluminum foil layers are separated into the thin-strip-like plastic film fragments 83a and aluminum foil fragments 83b which are indefinite in size but which have a diameter of about 2 to 6 mm, by means of the impact frictional striking force.

In short, the fragments to be processed 82 are smashed by the impact striking force applied from the fixed and movable pins 134 and 144, whereby the paper layer on the surface of the fragments to be processed 82 is minutely crushed or fractured. At the same time, the fragment to be processed 82 repetitively undergoes a bending action, causing the minutely fractured paper layer to be separated from the fragment to be processed

82.

In this way, the paper and plastic film, or the paper, plastic film and aluminum foil layers of the fragment to be processed 82 are peeled and separated from one another according to the type of layer. The paper layer is fibrously disentangled, whilst the plastic film and aluminum foil layers are separated into the plastic film fragments 83a and the aluminum foil fragments 83b, respectively. Meanwhile, the thus separated fibrous paper layer and the plastic film fragments 83a, or the mixture of the fibrous paper layer, the plastic film fragments 83a, and the aluminum foil fragments 83b move close to the screen 151 provided along the outer periphery of the separator 130, by virtue of centrifugal force resulting from the rotation of the movable disk 141, suction applied by the blower 157, or an airflow caused by the compressed air fed to the processing space 155 via the pipe 236. Only the fibrous paper layers pass through the screen 151 having meshes which measure 0.8 to 2 mm and are discharged into the discharge space 156. The fibrous paper layers are then conveyed to the outside via the exit 152 and the blower 157. They are then collected into the collecting tank 250 via the discharge pipe 239, and the fibrous paper layers are classified and recycled in the form of the aggregated and flocculated paper fibers 84.

On the other hand, neither the plastic film fragments 83a nor the mixture of the plastic film fragments 83a and the aluminum foil fragments 83b pass through the screen 151, and they remain in the processing chamber.

After the completion of the collection of the paper fibers 84, the outlet port 153 and the processing space 155 are connected together via the communicating pipe 235, as required. The plastic film fragments 83a, or the mixture of the plastic film fragments 83a and the aluminum foil fragments 83b remaining in the processing space are returned again to the processing space 155. As a result, it becomes possible to further remove the paper layer still adhering to the plastic film fragments 83a and the aluminum foil fragments 83b. Thereafter, the plastic film fragments 83a, or the mixture of the plastic film fragments 83a and the aluminum foil 83b thus separated from the paper layer are discharged to the outside from the outlet port 153.

Using the two-way solenoid valve 238 of the branch pipe 237 provided in the communicating pipe 235 in the vicinity of the inlet port 132 so as to communicate with the collecting tank 240 for collecting the plastic film fragments 83a, the communicating pipe 235 has its downstream end closed and the other side located near the branch pipe 237 is opened. As a result, the plastic film fragments 83a, or the mixture of the plastic film fragments 83a and the aluminum foil fragments 83b are introduced by a suction force into the collecting tank 240 via the branch pipe 237.

As shown in Fig. 3, the communicating pipe 235 is connected to the branch pipe 237 by means of a flange 154 disposed in a pipe between the upstream side of the communicating pipe 235 and the outlet port 153 (in a rearward direction in Fig. 3).

The thus-collected paper fibers 84 are recycled by the known method. The outer periphery of the above-described paper containers; that is, the surface of the plastic film layer covering the paper layer, has printed layer such as a trade name, a trademark, and indications related to contents. These printed layers do not come away from the surface of the plastic film even as a result of the processing in the separator. Since the printed matters remain adhered to the surface of the plastic film fragments 83a, the paper fibers 84 thus collected in the above described step are free from ink provided on the surface of the plastic film.

Classifying Step: Wind Force Clasifying Step 305

In the case of the laminated films to be recycled comprising a plastic layer and an aluminum foil layer, a plurality of layers, that is, the plastic and aluminum foil layers, are separated to substantially the same size as a result of application of the impact frictional striking force in the preceding peeling and separating step 303, and they remain in the separator. This step is to classify the thus-remaining separated fragments by the difference in specific gravity such that the fragments are individually collected. This step is carried out not only for the case of the laminated film comprising paper, plastic film, and aluminum foil layers, but also for the case of laminated films made by the polymerization of aluminum foil and a plastic film. Like the case of the laminated film which comprises paper and plastic film and is used as one example in the descriptions of the preceding step, if the laminated films comprise layers which are separated into different size by the impact frictional striking force, they can be collected according to the type of layer by classifying carried out in the peeling and separating step 303. Hence, the present step may be omitted.

Taking the laminated film comprising paper, plastic film, and aluminum foil layers as an example of an object to be recycled, the plastic film fragments 83a and the aluminum fragments 83b withdrawn by the removal means in the preceding step are mixed together when they are taken out of the separator 130. Using a suction type wind-force classifier 30 which includes a blower 33 equipped with a cyclone 31 and is capable of applying a suction force at a rate of 200 to 500 Kg/h, the plastic film fragments 83 are collected from the mixture by suction, whereby the aluminum foil fragments 83b are also taken out (Fig. 1).

In this way, it is possible to individually collect the plastic film fragments 83a and the aluminum fragments 83b. The amount of another layer adhering to the plastic film fragments 83a and the aluminum foil fragments 83b is very small.

For these reasons, the thus-collected aluminum fragments are recycled as raw materials of various aluminum products. Further, the plastic film fragments are compressed into pellets, and these pellets can be recy-

cled as raw materials of various molded plastic products. Molded plastic articles which are reproduced from the raw materials, i.e. , the plastic film fragments collected in the present step, are colored by the print ink adhered to the surface of the plastic film fragments. Therefore, applications of the thus-recycled plastic materials are limited to molded products, such as artificial lumber and colored wrapping films, in which coloring does not cause any problems.

Results of the test of recycling of laminated films using the recycling apparatus of the present invention will be described hereinbelow.

Embodiment 1

Milk cartons used as a container of milk were collected, and a 60 g of laminated film forming the milk cartons was treated as a subject to be recycled.

The milk cartons were made of a laminated film, and the laminated film was comprised of a paperboard having both sides coated with polyethylene layers. The ratio of the paperboard layer to the polyethylene film layer was 51.1 g (83.5 wt.%) to 9.9 g (16.5 wt.%) including the weight of print ink. The thickness of the film of the milk carton was about 0.5 mm, and the thickness of the top of the package where the films are bonded together was about 2.2 mm. The thickness of the bottom of the package where the films are also bonded together was about 1.1 mm.

The above described milk cartons were shredded into square fragments having a side of 6 to 10 mm using the milling cutter, whereby fragments to be processed were obtained. These fragments to be processed (60 g) were introduced into the separator equipped with a 0.8-mm mesh screen and rotating at 55 Hz and 1200 r.p.m. The impact fictional striking force was applied to the fragments to be processed for about five minutes.

After the rotation of the separator, the separation of the polyethylene film layer from the paper layer suddenly started after the lapse of about 2 and half minutes. The thus-separated paper layer was separated into minute fibers, and the thus-struck fibers classified by passing through the screen with apertures having a diameter of 1 mm. The fibers were then discharged to the outside of the separator and were sent to the tank 250 via the discharge pipe 239 by suction of the blower 157. In the end, the aggregated and flocculated paper fibers were obtained.

On the other hand, the polyethylene film layer peeled off or separated from the paper layer remained in a struck condition in the separator. The polyethylene film layer was then sent to the tank 240 via the branch pipe 237 by means of the operation of the solenoid valve. Thus, the polyethylene film layer was collected while being separated from the paper layer.

As described above, the struck paper layer and polyethylene film layer were substantially completely separated from each other after the lapse of about three to five minutes since the separator was activated. In the end, they were able to be individually collected.

A printed surface on the outer surface of the milk carton remained on the polyethylene film fragments, just as it was. No ink adhered to the collected paper fibers.

The thus-collected paper fibers are usable as pulp materials which are materials of recycled paper. On the other hand, the polyethylene film fragments are usable as materials of various plastic products.

Embodiment 2

The recycling test was carried out using 60 g of brick-type paper containers of fruit juice. The paper containers were made of a paperboard having its front side (the side which appeared outside when the paperboard was formed into a container) covered with a polyethylene film, and its rear side (the side which appeared inside of a container when the paperboard was formed into the container) coated with a film made by the polymerization of aluminum foil and a polyethylene film, in that order.

The laminated paper (60 g) obtained from the brick-type paper containers had the ratio of the paper layer to the polyethylene film layer and the aluminum foil layer, being 48.6 g (81.0 wt.%) to 11.4 g (19.0 wt.%) which includes the weight of print ink. Further, the ratio of the polyethylene layer to the aluminum foil layer was 2.0 g (17.7 wt.%) to 9.4 g (82.3 wt.%).

The thickness of the laminated film which formed the brick-type paper packages was about 0.4 to 0.5 mm.

The above-described brick-type paper packages were shredded into square fragments having a side of 6 to 10 mm after having been preferably cleaned and dried, whereby the fragments to be processed were obtained. These fragments to be processed (60 g) were introduced into the separator which rotates at 60 Hz and 1400 r.p.m. The impact frictional striking force was applied to the fragments to be processed (60 g) for about five minutes.

As a result of the rotation of the separator which contains the fragments to be processed, the paper layer in the fragments to be processed was disentangled into fibers. The polyethylene film layer and the aluminum foil layer were struck and separated into thin-strip-shaped polyethylene film fragments and aluminum foil fragments. Of these processed substances, the fibrously disentangled paper layer classified by passing through the screen with apertures which have a width of 1 mm. The paper layer was discharged to the outside of the separator and was collected in the form of aggregated and flocculated paper fibers.

On the other hand, the plastic film fragments and the aluminum foil fragments which were struck into thin strips having indefinite shape and measuring about 2 to 6 mm and could not pass through the screen mixedly remained in the separator. They were thus collected.

As with the paper fibers in the first embodiment, no print ink adhered to the thus-collected paper fibers.

Subsequently, the polyethylene film fragment and the aluminum foil fragment mixedly remaining in the separator were taken out of the separator, and then they were classified in wind force classifying step 305 using the cyclone, whereby they were individually collected.

The paper layer substantially adhered to neither the thus-collected polyethylene fragment nor the aluminum foil fragment, and hence they are usable as raw materials of various aluminum products and raw materials of molded plastic products.

Embodiment 3

Using the same samples as those used in Embodiments 1 and 2, the same fragments to be processed were prepared and were introduced into the separator equipped with a 1.8-mm mesh screen and rotating at 20 Hz and 400 r.p.m. An impact frictional striking force was applied to the fragments to be processed for about seven minutes.

The solenoid valve (not shown) disposed at downstream of the blower 157 was activated for one minute, and separated foreign articles were collected in the first tank. Most of them were protein and oil and fat of the milk and impurities other than paper fibers. Subsequently, the three-way solenoid valve was switched for four minutes, and separated substances were collected in the second tank. They were high-quality long paper fibers without foreign articles. The thus-collected paper fibers accounted for about 70% of the entire volume of the recycled paper fibers. The three-way solenoid valve was further switched for one to two minutes, and resultant paper fibers completely separated from plastic or plastic and aluminum foil were collected in the third tank. The thus-obtained paper fibers accounted for about 30% of the entire volume of the recycled paper fibers.

After having classified the paper fibers obtained in Embodiments 1 and 3 using 40-mesh screen, 47% of the paper fibers obtained in Embodiment 1 remained on the screen, and 67.5% of the paper fibers obtained in Embodiment 3 remained on the screen. It turned out that the paper fibers obtained in Embodiment 3 were sufficiently usable as a white paper board because they were long. For the pulp-like substances obtained as a result of the water disaggregation of the samples of Embodiment 1, 75.1% of them remains on the screen. Even when they were processed using the separator in Embodiment 3, only 10% or thereabouts of the paper fibers were destroyed. As a result of the observation of the paper fibers using a microscope, the paper fibers collected in Embodiment 3 were substantially the same in length as the material pulp, and they were free from stranded fibers. Thus, they were also suitable for recycling purposes.

Since the recycling method and apparatus of the present invention has the above described configuration, it is possible to separate and collect the layers of the laminated film according to the type of layer only by applying the impact frictional striking force to the fragments to be processed produced from the laminated film. Compared with the conventional method and apparatus for recycling the laminated film comprising a paper layer, the recycling method and apparatus of the present invention makes it possible to recycle the laminated films with a fewer number of processing steps and using smaller-scale equipment. Further, the method and apparatus of the present invention carries out only dry processing. Hence, there is no risk of pollution due to waste liquids, which in turn makes it possible to reduce the burdens associated with the processing of the waste liquids.

According to the method and apparatus of the present invention, it is possible to individually collect the layers of the laminated film according to the type of layer, and it is also possible to recycle laminated films which do not include any paper layers. Therefore, it is possible to recycle not only the paper layer which is recycled as reproduced paper but also other plastic film and aluminum foil layers.

Thus the broadest claims that follow are not directed to a machine that is configure in a specific way. Instead, said broadest claims are intended to protect the heart or essence of this breakthrough invention. This invention is clearly new and useful. Moreover, it was not obvious to those of ordinary skill in the art at the time it was made, in view of the prior art when considered as a whole.

Moreover, in view of the revolutionary nature of this invention, it is clearly a pioneering invention. As such, the claims that follow are entitled to very broad interpretation so as to protect the heart of this invention, as a matter of law.

It will thus be seen that the objects set forth above, and those made apparent from the foregoing description, are efficiently attained and since certain changes may be made in the above construction without departing from the scope of the invention, it is intended that all matters contained in the foregoing description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

It is also to be understood that the following claims are intended to cover all of the generic and specific features of the invention herein described, and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

Now that the invention has been described;

EXPLANATION OF REFERENCE NUMERAL

30	Wind force classifier
31	Cyclone
33	Blower
82	Fragments to be processed
83a	Plastic film fragments
83b	Aluminum foil fragments
84	Paper fiber
120	Shredder(Milling cutter)

121 Milling cutter main body
123 Inlet port
124 Cutter support
125 Rotary blade
126 Fixed blade
129 Screen
130 Peeling/Separating (Classifying) apparatus (Separator)
131 Fixed disk
132 Inlet port
133 Fixed end plate
134 Fixed Pin
135 Circumferential side plate
141 Movable disk
142 Rotary shaft
143 Bearings
144 Movable pin
151 Screen
152 Dicharge port
153 Outlet port
154 Flange
155 Processing space
156 Discharge space
157 Blower
158 Blower
235 Communicating pipe
236 Pipe
237 Branch pipe
238 Solenoid valve

Claims

1. A method for recycling a laminated film which includes a plurality of layers made of different materials, the method comprising at least the following steps of:

   shredding the laminated film into a plurality of fragments to be processed; and
   peeling or separating layers of the fragments to be processed according to the type of layer by applying an impact frictional striking force to each of the fragments to be processed formed in the preceding step.

2. The method for recycling a laminated film according to claim 1, further comprising a step of classifying the peeled or separated layers of the fragments to be processed.

3. The method for recycling a laminated film according to claim 1 or 2, further comprising a step of collecting the layers in a layer-by-layer manner by classifying each of the layers of the fragments to be processed which has been peeled or separated in the preceding step according to the type of layer.

4. The method for recycling a laminated film according to claim 1, wherein the laminated film includes at least a paper layer.

5. The method for recycling a laminated film according to claim 1, further comprising a step of peeling or separating a laminated film having a paper layer and a plastic film layer into a fibrously struck paper layer and a plastic film layer separated into a thin strip, and collecting the fibrously struck paper layer as paper fibers by classifying it from the plastic film layer.

6. The method for recycling a laminated film according to claim 1, further comprising the following steps of:

   peeling or separating a laminated film having a paper layer, a plastic film layer, and an aluminum foil layer into a fibrously struck paper layer, a plastic film layer separated into a thin strip, and an aluminum foil layer separated into a thin strip, and collecting the fibrously struck paper layer as paper fibers by classifying it from the plastic film layer and the aluminum foil layer; and
   individually collecting the plastic film layer and the aluminum foil layer by classifying the plastic film layer from the aluminum film layer using a wind force.

7. The method for recycling a laminated film according to claim 1, wherein the fragment to be processed undergoes promotion of water disaggregation before and after the step of shredding the laminated film into the plurality of fragments to be processed or in the step of applying the impact frictional striking force to each of the fragments to be processed.

8. An apparatus for a recycling laminated film having a plurality of layers made of different materials, the apparatus comprising at least:

   shredder which shreds the multilayered film into a plurality of fragments to be processed;
   fixed-side peeling and separating means which includes a fixed disk having the center thereof communicated with an inlet port for introducing the fragments to be processed and pins fixedly provided on the fixed disk in the order so as to trace out a plurality of rotary trajectories;
   movable-side peeling and separating means which includes a movable disk rotatably provided so as to be opposite to the fixed disk and movable pins provided on the movable disk in the order so as to trace out a plurality of rotary trajectories different from those which the fixed pins trace out;
   means for taking out the struck fragments to an outlet port; and
   peeling and separating means for peeling or separating the layers of the laminated film

according to the type of layer by impact striking the fragments to be processed between the fixed and movable pins using the impact frictional striking force.

9. The apparatus for recycling a laminated film according to claim 8, further comprising:

collecting means which is disposed along the outer periphery defined by combination of the fixed pins and the movable pins and which communicates with an outlet port via a screen having small apertures formed therein, each aperture of a predetermined diameter;
means for taking out the struck fragments remaining in the screen via the outlet port; and
peeling and separating means for peeling or separating the layers of the laminated film according to the type of layer by impact striking the fragments to be processed between the fixed and movable pins using the impact frictional striking force.

10. The apparatus for recycling a laminated film according to claim 8 or 9, further comprising:

wind force classifying means which classifies the peeled or separated layers by a wind force, and which individually collects the layers as a result of the classification.

11. The apparatus for recycling a laminated film according to claim 8, wherein the outlet port is connected to the inlet port via a communicating pipe having a blower.

12. The apparatus for recycling a laminated film according to claim 8, wherein a pipe for feeding compressed air is connected to the communicating pipe which connects the outlet port to the inlet port so as to introduce the compressed air into the communicating pipe.

13. The apparatus for recycling a laminated film according to claim 11, wherein a branch pipe which communicates to a tank for collecting the plastic film fragment or the mixture of plastic film and aluminum foil fragment is disposed at the inlet port side of the communicating pipe, and a two-way solenoid valved is disposed at the branch pipe.

14. The apparatus for recycling a laminated film according to claim 13, wherein a solenoid valve for opening and closing the branch pipe, and a solenoid valve for opening and closing the downstream side of the communicating pipe are provided, and these two solenoid valves are alternately opened and closed.

15. The apparatus for recycling a laminated film according to claim 9, wherein the outlet port is connected to the collecting tank by way of a discharge pipe having a blower.

16. The apparatus for recycling a laminated film according to claim 15, wherein the outlet port is connected to three collecting tanks by way of a discharge pipe having a blower and a three-way solenoid.

FIG. 1

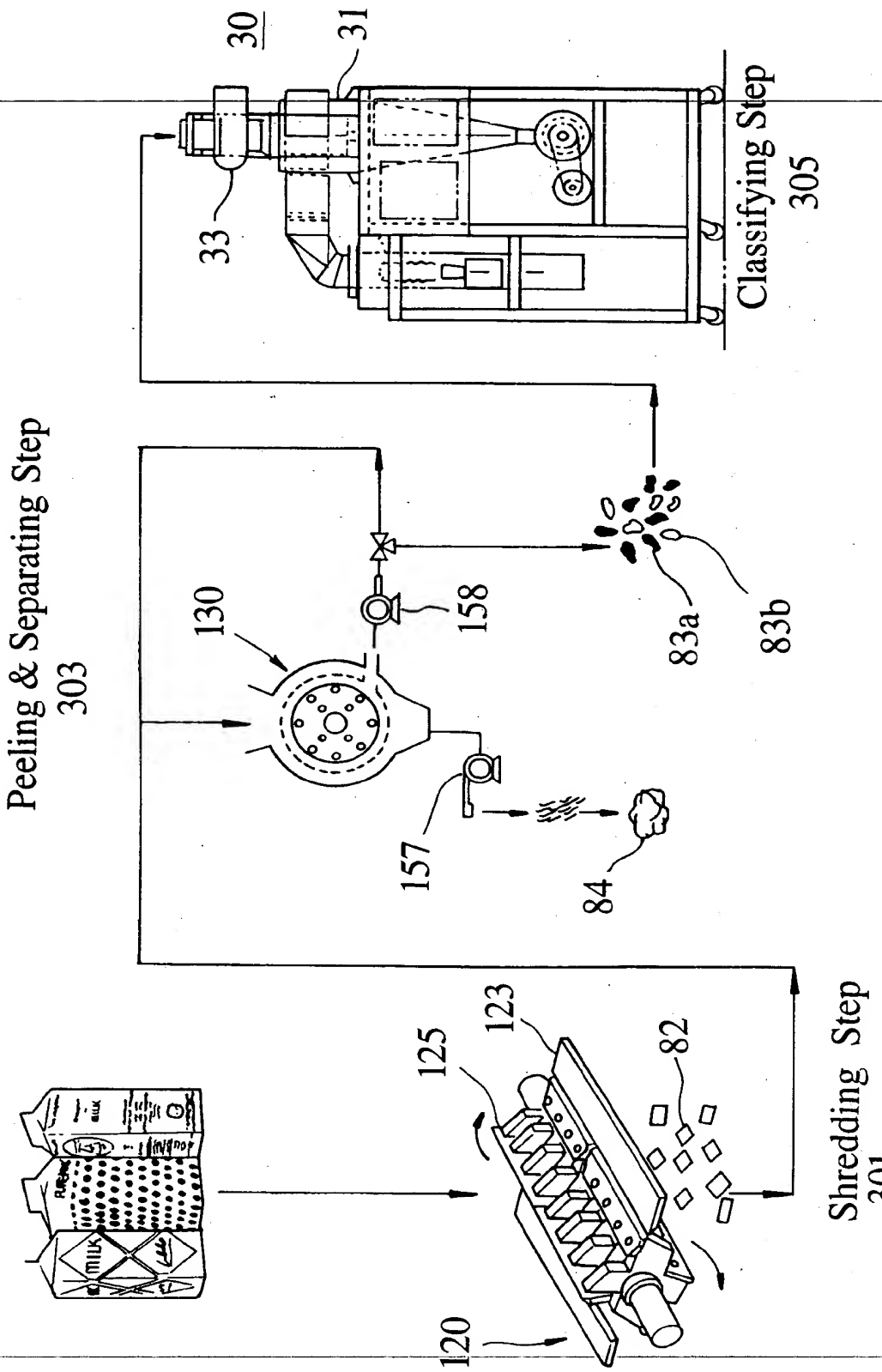
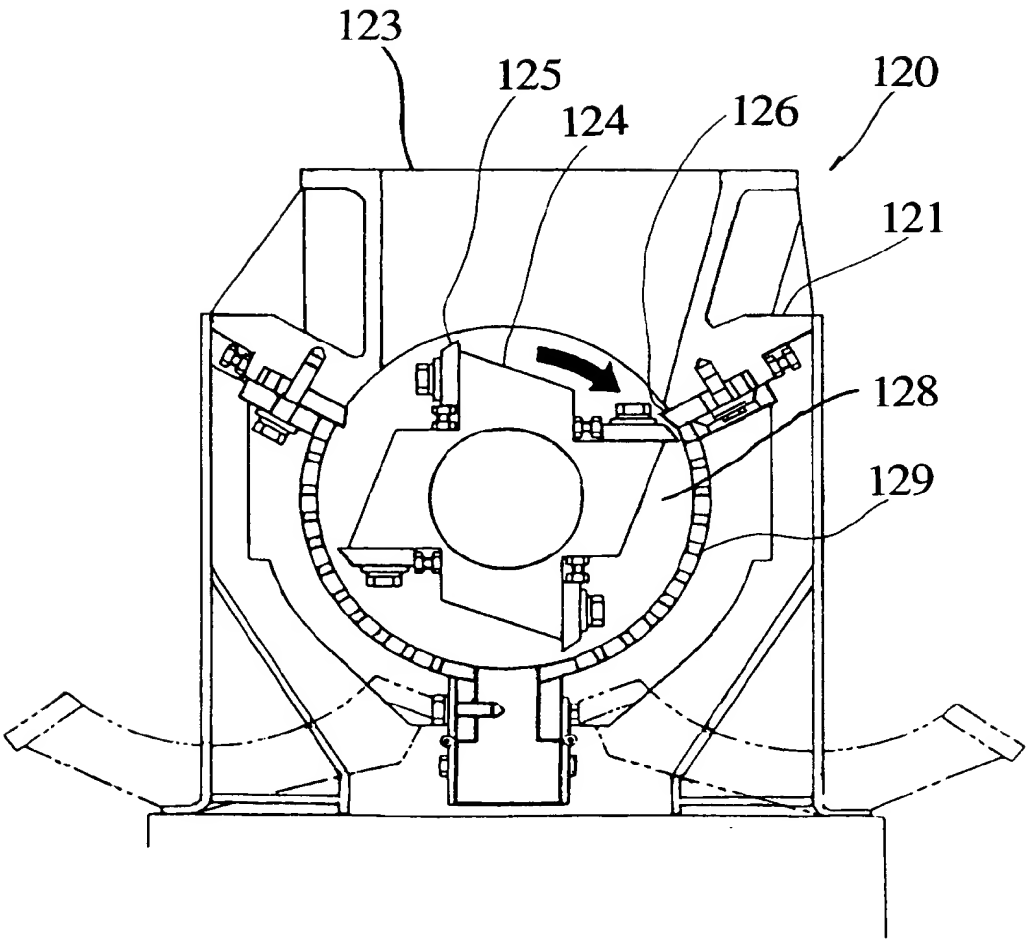


FIG. 2



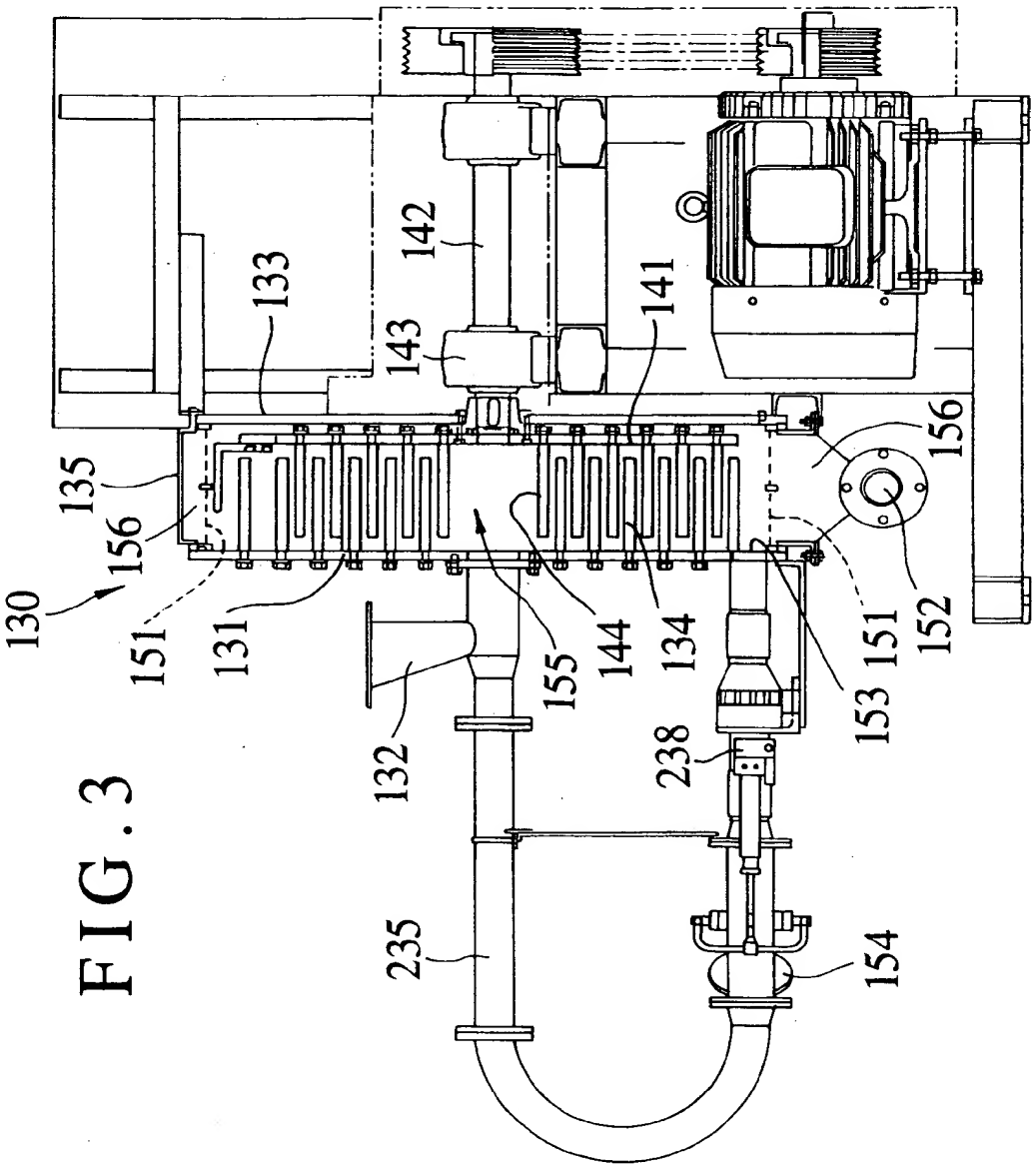


FIG. 3

FIG. 4

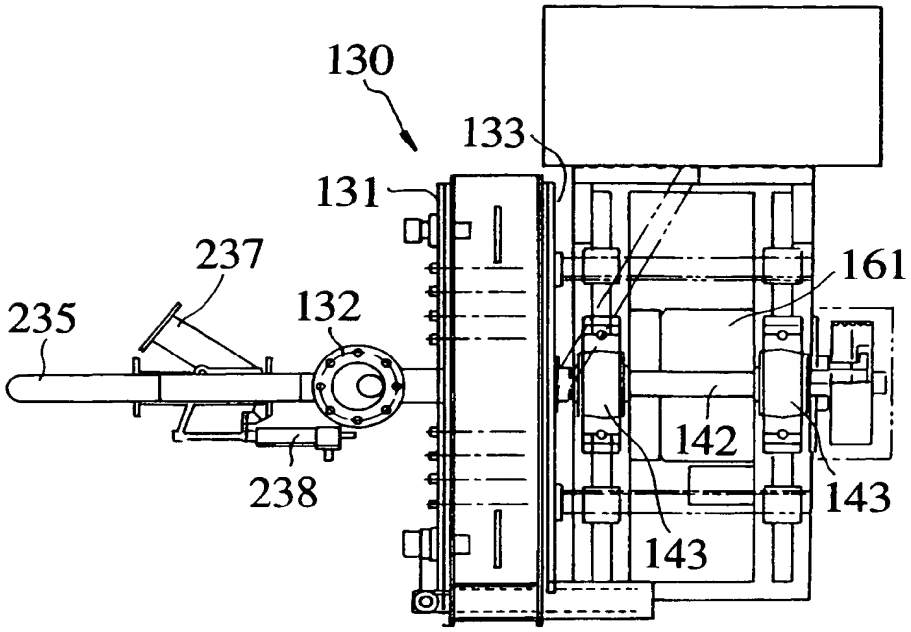


FIG. 5

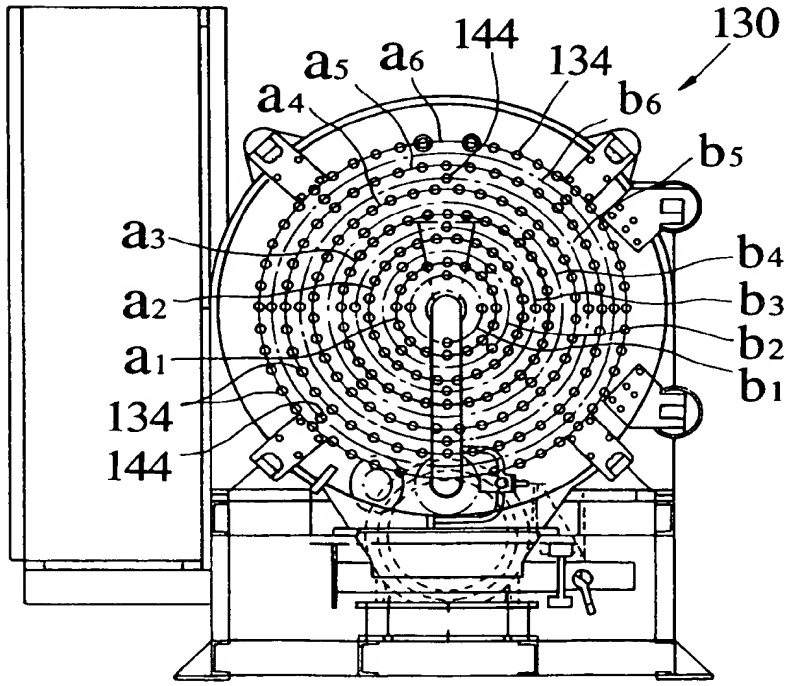


FIG. 6

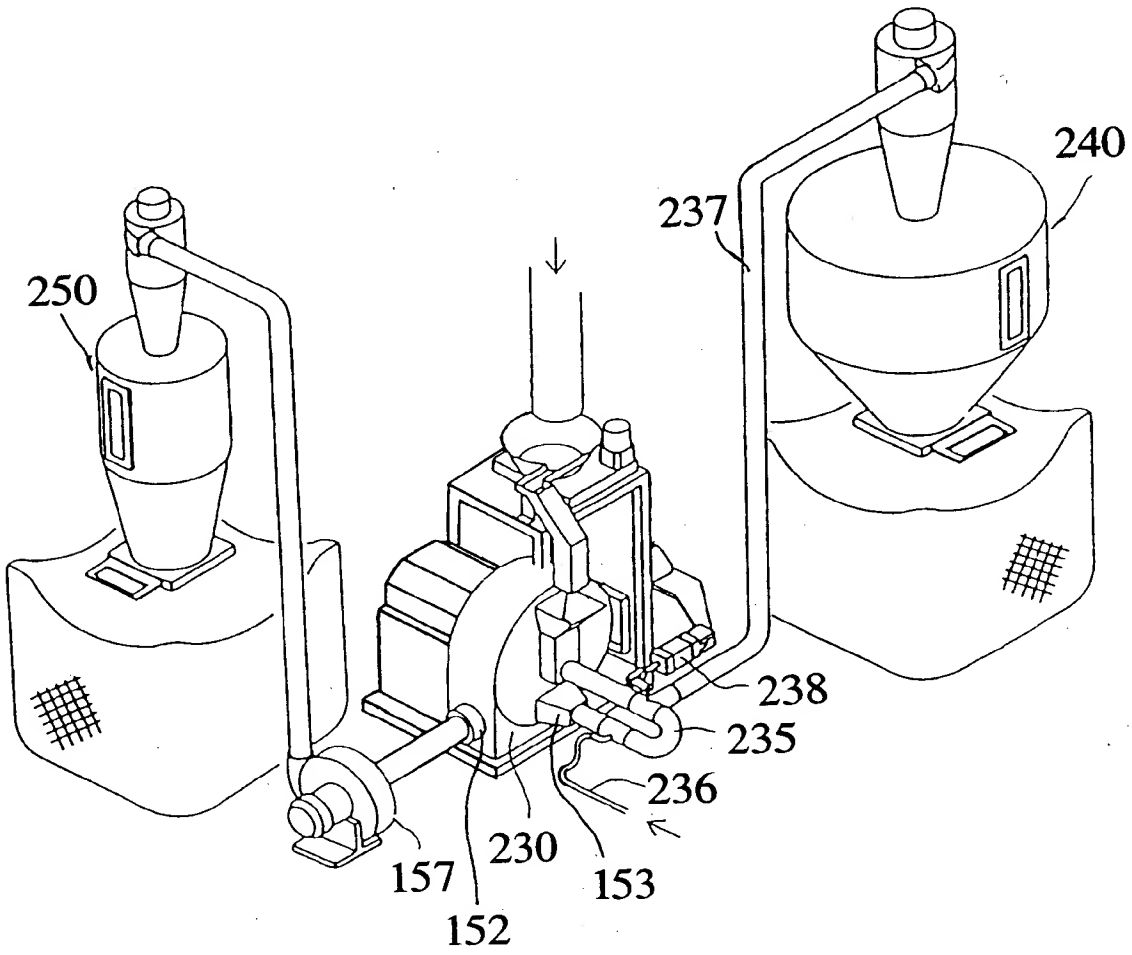
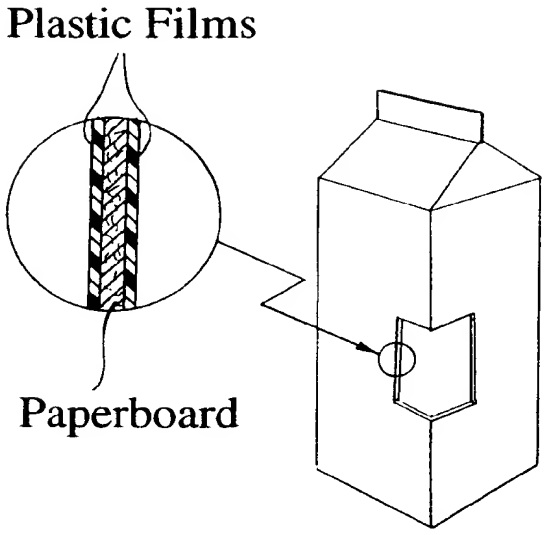


FIG. 7



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EUROPEAN SEARCH REPORT

Application Number
EP 96 11 9370

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	DE 33 43 788 A (STEFFENS BERT) 13 June 1985 * page 21, line 29 - page 23, line 4 * * page 24, line 4 - page 24, line 12; claims 5,10; figures 7,10 *	1-5,8,9	D21B1/02 D21B1/32 B02C13/22 B02C18/14 B07B4/00
Y		6,7,10, 11,15	
X	US 4 483 488 A (LUFF BRUCE A ET AL) 20 November 1984 * abstract; claim 1; figures *	1-3	
Y		10	
X	US 5 297 741 A (ZUERN JOERG ET AL) 29 March 1994 * claim 1; figures 1,4-7 *	1-3	
Y		10,11,15	
Y	FR 2 366 065 A (VYZK USTAV PAPIERU CELULOZY) 28 April 1978 * claim 1; figure *	6,7	
Y	DE 27 04 035 A (CONDUX WERK;ENGELSMANN AG J; SCHICKEDANZ VER PAPIERWERK) 3 August 1978 * page 7, paragraph 2 - page 7, paragraph 3 *	11,15	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)
D21B
B02C
B07B
B32B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	21 July 1997	Guisan, T

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